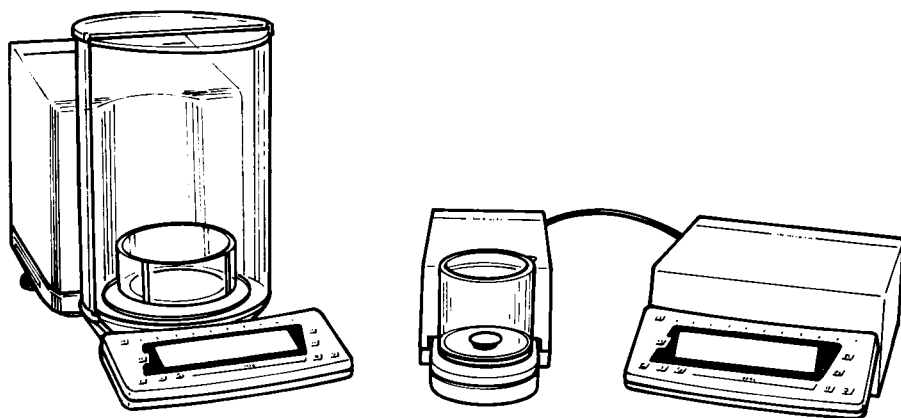# Sartorius Micro

Analytical, Semi-micro- and Microbalances
Installation and Operating Instructions
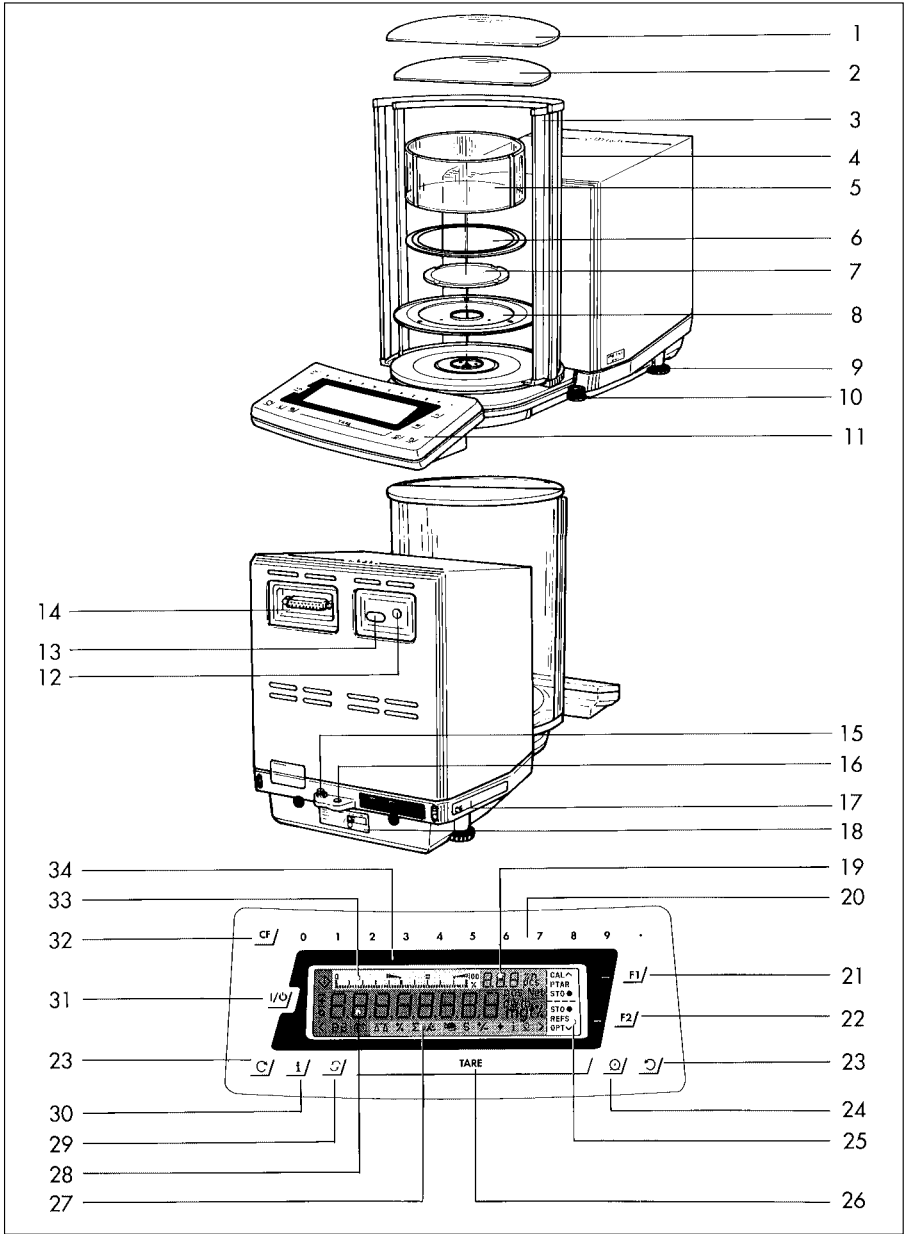
sartorius

Contents

General View of the Balances:
MC 210 S, MC 210 P and MC 410 S (-0CE)

1 Large draft shield cover

2 Small draft shield cover

3 Exterior draft shield element, semicylindrical (can be moved by hand)

4 Interior draft shield door, semicylindrical (can be moved by motor control or by hand)

5 Interior weighing chamber draft shield only on MC 210 S, MC 210 P (-0CE)

6 Protective ring

7 Weighing pan

8 Protective disk

9 Leveling foot

10 Level indicator

11 Display unit

12 AC jack/power socket

13 Menu access switch

14 Data interface port

15 Terminal for connecting an equipotential bonding conductor

16 Lug for attaching an antitheft locking device

17 Metrological ID label for verified balances approved for use as legal measuring instruments

18 Manufacturer's label

19 Application display

20 Numeric keys

21 F1/ function key

22 F2/ function key

23 C/ and ⊃/ draft shield function keys

24 ◎/ Print key (data transfer)

25 Function display for the F1/ and F2/ keys

26 TARE/ Tare key

27 Application program display

28 Weight display

29 ⊆/ toggle key

30 Info key

31 ON/OFF key I/O/

32 CF/ key

33 Bar graph (range indicator)

34 Verification ID label with metrological data for verified balances approved for use as legal measuring instruments

General View of the Balances:
MC 5 (-0CE) and SC 2 (-0CE)

7 Weighing pan

8 Protective disk

9 Leveling foot

10 Level indicator

11 Display and control unit

12 AC jack

13 Menu access switch

14 Data interface port

15 Terminal for connecting an equipotential bonding conductor

16 Lug for attaching an antitheft locking device

17 Metrological ID label for verified balances approved for use as legal measuring instruments

18 Manufacturer's label (on bottom of balance)

19 Application display

20 Numeric keys

21 F1/ function key

22 F2/ function key

23 C/ and D/ draft shield function keys (for opening and closing)

24 O/ Print key (data transfer)

25 Function display for the F1/ and F2/ keys

26 TARE/ Tare key

27 Application program display

28 Weight display

29 S/ toggle key

30 Info key

31 ON/OFF key I/O/

32 CF/ key

33 Bar graph (range indicator)

34 Draft shield

35 Weighing cell

36 Inner draft shield

37 Below-balance weighing port

38 Male connector on weighing cell

39 Male connector on computing device

40 Electronic computing device

Please read these installation and operating instructions carefully before you begin to operate your new balance.

Warranty

Do not miss out on the benefits of our full warranty. Please contact your local Sartorius office or dealer for further information. If available, complete the warranty registration card, indicating the date of installation, and return the card to your Sartorius office or dealer.

Storage and Shipping Conditions

Allowable storage temperature: +5°C ... +40°C
                                                          +41°F to +104°F

The complete packaging has been designed to ensure that the balance will not be damaged even if it is dropped from a height of 80 cm (about 31 inches).

After unpacking the balance, please check it immediately for any visible damage as a result of rough handling during shipment.
If this is the case, proceed as directed in the section entitled "Safety Inspection."

Save all parts of the packaging and the box for your balance to avoid damage during transportation. Ship your balance only in the complete original standard packaging supplied.

The packaging consists of the following:
– 2 boxes
– 3 polystyrene inserts
– 2 polypropylene pads

The inner packaging is not suitable for shipping because it provides the balance little protection from blows. Before packing your balance for shipment, unplug all connected cables to prevent damage.

Do not expose the balance unnecessarily to extreme temperatures, moisture, shocks, blows or vibrations.

Transporting the Balance
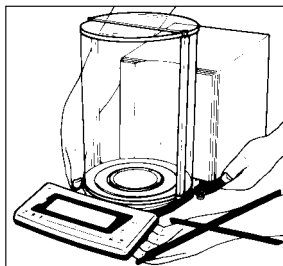
To transport the balance, lift it by the housing base using both hands. Never lift your balance by grasping the display unit or the draft shield!

Transport Arrestment

Before unplugging the balance from the power supply or unplugging the connecting cable, turn off the balance using the ⏻ key **(31)**.
For MC5 (-0CE) and SC 2 (-0CE):
After approximately 10 seconds, the balance will be arrested, or locked, for transportation.
While the balance is raising the weights after you have turned it off, the symbol "Mot" from a calibration or linearization procedure is displayed.

Warmup Time
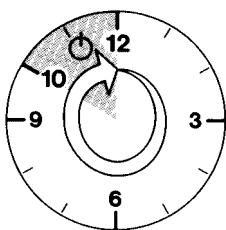
Condition your balance for 12 hours to the temperature of a new location. After initially connecting the balance to AC power (or after a relatively long power outage), allow it to warm up for at least 2 hours.

Each time you move your balance to another location, you must condition it for at least 12 hours to the new location.
After initially connecting the balance to AC power (or after a relatively long power outage), allow the balance to warm up for at least 2 hours.

Note to Users of Verified Balances Approved for Use as Legal Measuring Instruments:

Preparing a Verified Balance for Use as a Legal Measuring Instrument:
After initially connecting the balance to AC power (or after a relatively long power outage), allow it to warm up for at least 24 hours.

Linearization after Transport

After transport, the linearity and calibration of your balance may be out of the permissible tolerances (see the "Specifications"). **Always carry out internal linearization of the balance after transport.**
Repeating this procedure – several times, if necessary – enhances the linearization. This procedure is described on page 1–35.

Equipment Supplied

The equipment supplied includes the components listed below:

MC 210 S, MC 210 P and MC 410 S (-0CE)
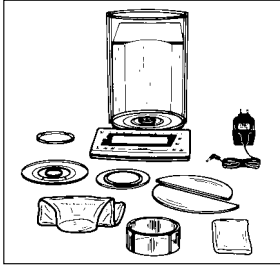
– Weighing cell
– AC adapter
– Weighing pan
– Protective disk
– Protective ring
– Interior weighing chamber draft shield
– 2 draft shield covers
– Dust cover for the draft shield and the balance housing
– Dust cover for the display unit

MC 5 (-0CE) and SC 2 (-0CE)
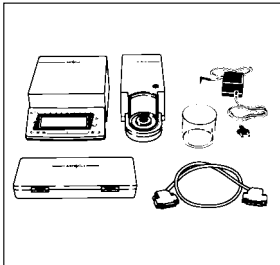
– Weighing cell
– Draft shield
– Electronic computing device
– Connecting cable
– Power supply
– Kit of standard accessories
– Inner draft shield (models SC 2 and SC 2-0CE only)

The kit of standard accessories contains the following:
– Weighing pan
– Protective disk
– Brush
– Forceps
– Lint-free cloth

MC 21 S
– Weighing cell
– Electronic computing device
– Connecting cable
– Power supply
– Protective disk
– Protective ring
– Weighing pan

Installation Instructions
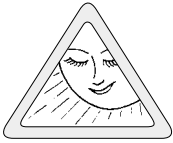
Ambient Conditions

Before you set up your balance, choose a suitable place which meets the following requirements:

– level, low-vibration weighing table or a wall console;

– no direct exposure to sunlight, heaters, or similar sources of heat. This can considerably increase the temperature inside the draft shield (greenhouse effect), resulting in incorrect readouts due to convection currents, turbulence and buoyancy effects;

– no drafts from open windows or doors;

– avoid brief fluctuations in room temperature.

The balance is not allowed to be used in hazardous areas/locations where there is danger of explosion.

Do not expose the balance to extreme moisture over long periods. Moisture in the air can condense on the surfaces of a cold balance whenever it is brought to a substantially warmer place. If you transfer the balance to a warmer area, make sure to condition it for about 2 hours at room temperature, leaving it unplugged.

Using Verified Balances Approved as Legal Measuring Instruments in Europe (only applies to MC5-0CE)

Using Verified Balances as Legal Measuring Instruments
You must calibrate the balance at the place of installation before using it as a legal measuring instrument (see the section entitled "Calibration/Adjustment" starting on page 1–31).

This balance is not allowed to be used for weighing goods intended for direct sale to the public. The type-approval certificate for verification applies only to non-automatic weighing instruments; for automatic operation with or without auxiliary measuring devices, you must comply with the regulations of your country applicable to the place of installation of your balance. A suitable thermometer and barometer are recommended for monitoring ambient conditions.

For balances of accuracy class Ⓘ, a thermometer and barometer are recommended for monitoring ambient conditions. The temperature range indicated on the verification ID label must not be exceeded during operation.

The balance must warm up for at least 24 hours after initial connection to AC power or after a relatively long power outage.

The legal background for using Sartorius balances in legal metrology is the EC Council Directive No. 90/384/EEC for non-automatic weighing instruments, which has been in effect since January 1, 1993, within the Internal European Market, as well as the accreditation of the Quality Management System of Sartorius AG by Lower Saxony's Regional Administrative Department of Legal Metrology (Niedersächsische Landesverwaltungsamt – Eichwesen) from February 15, 1993.

Getting Started

MC 210 S, MC 210 P and MC 410 S (-0CE):

**Important Note Concerning Verified Balances
Approved for Use as Legal Measuring Instruments:**
Provided that an official lead seal is required for the
verified balance, a control seal is affixed to the
balance. Unauthorized attempts to remove this seal
will irreversibly damage it. If you break the seal,
the validity of the verification will become void, and
you must have your balance subsequently verified.
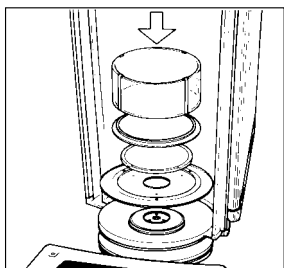
Place the components listed below inside the weighing
chamber one at a time in the order given:
– Shield disk **(8)**
– Weighing pan **(7)**
– Protective ring **(6)**
– Interior weighing chamber draft shield **(5)**
 (only on MC 210 S, MC 210 P (-0CE))
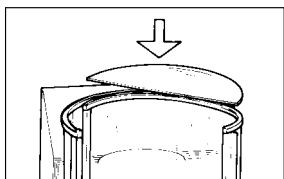
– Place the small draft shield cover **(2)** on top of the
 semicylindrical interior draft shield door **(4)**.
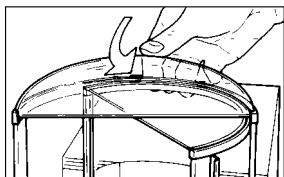
Then place the large draft shield cover **(1)** on top
of the semicylindrical exterior draft shield element **(3)**.
Secure the draft shield cover in place using the
fastener (see arrow).
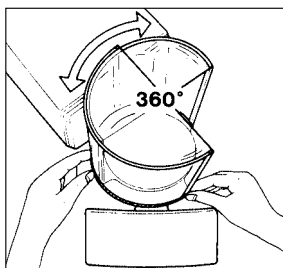
Adjusting the Exterior Draft Shield Element

Turn the exterior draft shield element (3) by the riffled part on the bottom to the position you desire. Depending on your application, you can define the menu code so that the interior draft shield door (4) is operated by motor or by hand (see section starting on page 1–21).
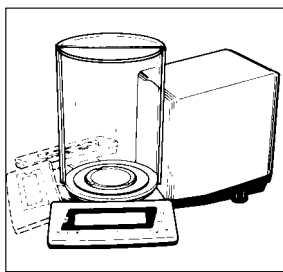
Adjusting the Swivel-Mounted Display Unit

Move the swivel-mounted display unit (11) around the base of the draft shield to adjust it to the position you desire (+/− 85°).

MC 21 S:

Installing the Components

● Place the following components on the balance in the order given below:

– Shield plate

– Weighing pan
  Note: To position the weighing pan, rotate it back and forth while pressing down gently.

– Protective ring

– Glass plate
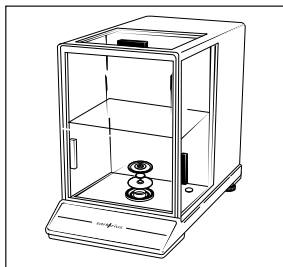
MC 5 (-0CE) and SC 2 (-0CE):

Assembling the Components
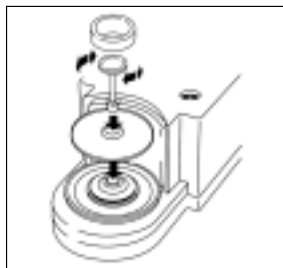
● Place the components listed below on the weighing cell **(35)** one at a time in the order given:

– Protective disk **(8)**

– Weighing pan **(7)**
  Important Note: After placing the weighing pan on the weighing cell, press down on it gently while turning it slightly to the left and right.

– Inner draft shield **(36)** (models SC 2 and SC 2-0CE only)

Installing and Adjusting the Draft Shield
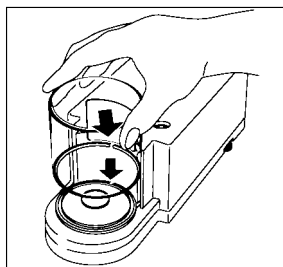
– Place the small draft shield **(34)** on the weighing cell and adjust it so that the gap fits over the projection on the weighing cell (see arrows).

Connecting the Weighing Cell to the Computing Device
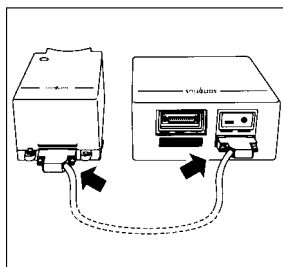
Connect these two units so that the two points where the connecting cable is attached to the female connectors face each other (see arrows).
Tighten the screws on the female connectors by hand.

Connecting the Balance to AC Power
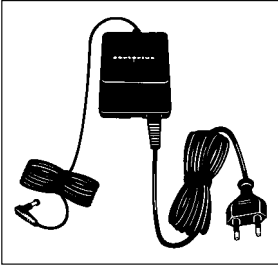
The balance is energized by a power supply/AC adapter. Make sure that the voltage rating printed on this unit is identical to your local line voltage.

If the voltage specified on the label or the plug design of the power supply/AC adapter does not match the rating or standard you use, please contact your Sartorius office or dealer.

Important Note:

Use only original Sartorius power supplies/AC adapters. Use of power supplies/AC adapters from other manufacturers, even if these units have an approval identification marking from a national testing laboratory, requires the consent of an authorized Sartorius service technician.

Detailed information on additional options for powering the balance is available in our service information bulletin, no. 15/88 (for example, using local extra-low voltage).
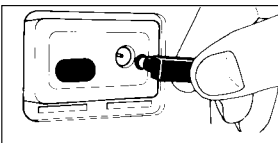
Plug the cord of the AC adapter/power supply into the DC jack on the rear panel of the balance/computing device. Then insert the plug of the power supply or the AC adapter into a wall outlet.
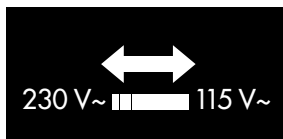
Voltage Selection

You can select the voltage if you use our portable power supply (6971172) that has a European-type plug (rounded prongs).

Safety Precautions

The power supply/AC adapter rated to Class 2 can be plugged into a wall outlet without taking any additional safety precautions. The pole of the output voltage is connected to the balance housing, which can be grounded for operation.

The data interface (see also "Interfacing Devices" on page 1–36) is also electrically connected to the balance housing (ground).

Information on Radio Frequency Interference

Warning!
This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference, when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

Connecting Electronic Devices (Peripherals)

Make sure to unplug the balance from the power supply/AC adapter before you connect or disconnect a peripheral device (printer or PC) to or from the interface port.
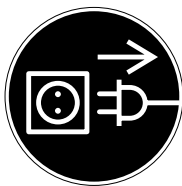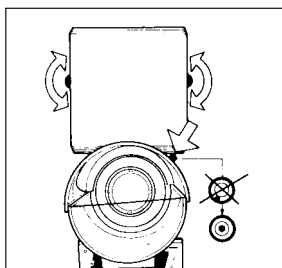
Leveling the Weighing Cell Using the Level Indicator

At the point of use, level the weighing cell using the leveling feet **(9)** so that the air bubble is centered within the circle of the level indicator **(10)**.

To level the weighing cell using the level indicator as a guide:
Extend the leveling feet (turn clockwise) to lift the weighing cell.
Retract the feet (turn counterclockwise) to lower the weighing cell.

General Instructions for "Analytical Weighing"
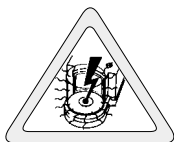
Weighing Electrostatically Charged Samples and Containers

Major measuring errors can occur when electrostatically charged samples and containers are weighed. This problem particularly involves samples that have an extremely poor electrical conductivity (glass, plastic, filters) since they can discharge electrostatic – i.e., friction-induced – charges only over a relatively long period of time. The result is an interaction of forces among the charges adhering to the sample and the stationary components of the balance (base plate of the weighing chamber, draft shield construction, balance housing). This is noticeable when the weight readout drifts. At a high humidity, this effect is not so pronounced or does not even occur at all due to the thin layer of water that condenses on the sample and, through conductive discharge, counteracts interfering static electricity.

In addition to taking purely mechanical counteractive measures (protecting the sample using a special antistatic weighing pan – see the "Accessories"), you can neutralize the surface charges by "bombarding" them with ions of the opposite polarity. This is an extremely effective method of eliminating static electricity on surfaces (antistatic ionizing blower, order no. YIB01).

The balance's environment, including the operator, can considerably interfere with weighing on account of static electricity. The balances of the MC Series have been designed to counteract this phenomenon: the glass surfaces of the draft shield have a special metallic coating.
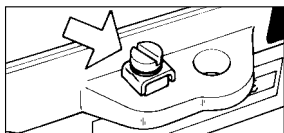
The rear panel of the balance/weighing cell has a terminal **(15)** for connecting an equipotential grounding conductor. It is used for additionally grounding a peripheral device (for example, a vibrating spatula). This terminal is designed for single grounding wires up to .25" standard gauge or 6 mm^2 and for .18" standard gauge or 4 mm^2 stranded wires.

Weighing Magnetic or Magnetizable Samples

It is technically impossible to avoid the use of magnetizable materials in the manufacture of balances. Ultimately, the operating principle of high-resolution balances is based on electromagnetic force compensation of the load placed on the weighing pan.

When magnetic or magnetizable samples or containers (e.g., beaker with a stirrer) are weighed, interactions among the above-mentioned components of the balance may occur, distorting weight readouts.
Unlike deviations caused by electrostatic charges, magnetic interference is usually constant over time. However, it is sensitive to and depends on the position of the sample or container on the weighing pan and is also characterized by poor reproducibility.

To reduce the effect described above, we recommend increasing the distance between the sample and the weighing pan by using a non-magnetizable material (the reduction in force is proportional to the quadrate of the distance). In special cases, soft-magnetic plates should be used to shield against interfering magnetic effects.

In the presence of extremely strong magnetic fields – for instance, when measuring the susceptibility of a sample in an electromagnet – you should use the below-balance weighing port which comes standard on your balance.

General Instructions for Handling Samples and Containers

As a general rule, the sample to be weighed should be conditioned to the temperature of the balance. This is the only way to avoid air buoyancy errors and deviations caused by convection currents at the surface of the sample. Since these effects increase proportionally to the volume and surface of the sample, make sure that the size of the tare vessel selected is in the appropriate proportion to the size of the sample to be weighed.

Never use your bare hands to touch samples to be weighed. In addition to the effect on the temperature, the extremely hygroscopic behavior of fingerprints left on the sample will cause considerable interference during weight measurement. Use forceps or other suitable utensils to place your sample carefully on the pan.

Working with your balance requires a steady hand and a smooth, uninterrupted technique.

Perform a few trial weighing operations before you begin with the actual weighing of your sample because the temperature in the weighing chamber may differ from that of the balance's surrounding environment, if the weighing chamber has not been opened for a relatively long period.

When you open the weighing chamber, a change in temperature will inevitably occur, due to the laws of physics, and may show up as a change in the weight readout. In this case, we recommend that before you begin the actual weighing series you open and close the weighing chamber at the same rate as you will be doing during weighing.

After the weighing chamber has been closed, the weight readout will usually stabilize after about 10 seconds. The accuracy of the weight readout will increase as you perform successive weighing procedures with greater consistency.

Operating the Balance

Balance Display
The display shows the following special codes
for your information:

OFF
The balance was disconnected from AC power
(power failure or outage; the balance was reconnected
to AC power).

O (standby)
The display has been turned off by the ⏻ key **(31)**.
The balance is now in the ready-to-operate mode.

◇ (busy)
Once you have turned on the balance, the ◇ symbol
will be displayed until you press a key.
During operation, this symbol indicates that the
balance processor is still busy processing a function
and will not accept commands to perform any other
functions at this time.

CAL I
The balance has internal calibration weights and
can be calibrated using the ᴵ⁺ᴵ key.

R1 ⚖ or R2 ⚖
The number in the R code identifies the particular
weighing range you have selected.

⚖
Symbol for the application selected (in this case,
the weighing mode and toggling among the
weighing ranges).

Important Note:
If the ⚖ symbol flashes, this means that the balance
wants to self-calibrate (see pp. 1–30).
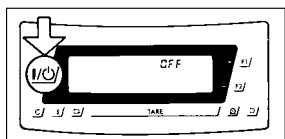
Turning the Display On and Off (Standby Mode)

Press the ⏻ key **(31)** to turn the display on or off.
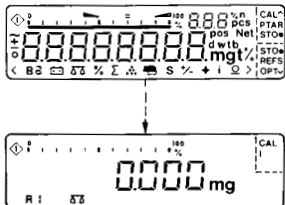
Self-Test

After the balance has been turned on, an automatic self-test of the balance's electronic circuitry is performed, and the draft shield closes automatically. When a zero readout is displayed, the balance is ready for operation.

Important Note Concerning Verified Balances Approved for Use as Legal Measuring Instruments in the E.U.*
For verified balances that have a verification scale interval "e" which is greater than the scale interval "d," and a scale interval "d" ≥0.1 mg, the last digit on the display is bordered.

Automatic Warmup of the Balance Electronics in MC 210 S, MC 210 P and MC 410 S (-0CE), MC 21 S
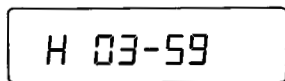
Once you have connected the balance to AC power and turned on the power, the balance's electronics automatically begin to warmup. The timer for warmup is set to 4 minutes. The remaining warmup time in minutes and seconds is displayed in a countdown mode.
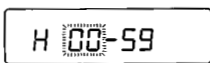
When the remaining time displayed is less than one minute, you can interrupt this warmup procedure by pressing the ⏻ key to turn the balance off and back on again. Following the self-test and display of a zero readout, the balance is ready to operate again.

After 4 minutes have elapsed, the balance displays a zero readout and is then ready to operate.

* = including the Signatories of the Agreement on the European Economic Area

Opening and Closing the Draft Shield

MC 210 S, MC 210 P or MC 410 S (-0CE):

To load small objects, open the draft shield only as far as is absolutely necessary for your application. This reduces the amount of draft so your balance will stabilize faster than it normally does when the draft shield is wide open.
You have several options for operating the interior draft shield door **(4)**:

– Semi-automatically using the ⊃/ or ⊂/ key **(23)** (max. aperature angle: 170°)
– Using an external foot or hand switch (see part 5, "Accessories")
– By a command from an on-line computer (see part 4, "Interface Description")
– Fully automatically, e.g., for the functions tare, calibration, print, etc. (see part 2, "Balance Operating Menu")
– With a special display mode while the draft shield is open (see part 2, "Balance Operating Menu")
– Manually
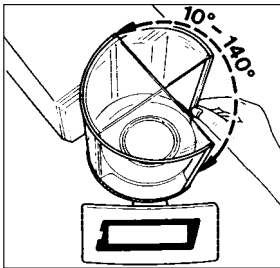
Semi-automatic Mode with an Aperture Angle of 10° to 140°

By a "self-teaching" function, the draft shield door can "learn" to open automatically to a user-defined aperture angle between 10° and 140°:

To define this angle, manually move the interior draft shield door **(4)** to the desired position.
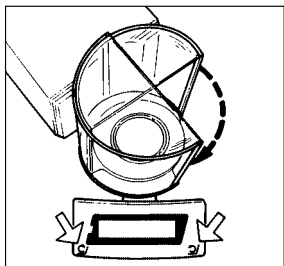
Press either ⊃/ or ⊂/ to close the draft shield automatically by motor. While closing, the interior draft shield door moves slowly. The previously adjusted aperture angle is stored.
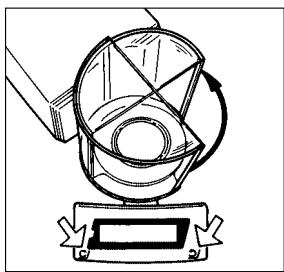
If you press either ⊃/ or ⊂/ once again, the draft shield door will open at a faster speed to the position you have selected. Press ⊃/ or ⊂/ for approx. 2 seconds to open the draft shield door automatically as far as it will go (170°).

You can always change the aperture angle by manually adjusting the position of the draft shield door.

Important Note

The aperture angle remains stored even after you have turned off the display by pressing ⏻/. A stored aperture setting will not be erased until you unplug the balance from AC power.

Manual Mode

Of course, you can also open and close the draft shield door by hand.

MC 5, SC 2 (-0CE):

You can operate the motorized draft shield **(34)** in one of the following ways:

– Semiautomatically using the ꜱ/ or ꜱ/ key **(23)**
  (aperature angle approx. 100°)
– Using an external foot or hand switch
  (see part 5, "Accessories")
– By a command from an on-line computer
  (see part 4, "Interface Description")
– Fully automatically, e.g., for the functions tare,
  calibration, print, etc. (see part 2, "Balance
  Operating Menu")
– With a special display mode while the draft shield
  is open (see part 2, "Balance Operating Menu")
– Manually

Semi-automatic Mode with the Aperture Angle of Your Choice
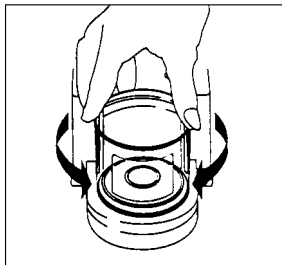
To define the aperture angle and the direction in which the draft shield opens, move the draft shield to the desired position manually (aperture angle 45° to 315°).
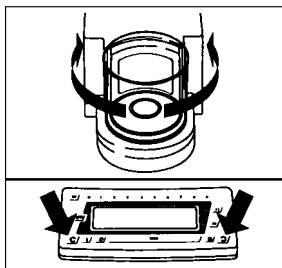
Press either the ᴼ/ or ᶜ/ key **(23)** to have the draft shield closed by motor. The previously adjusted aperture angle and the direction are stored in the process.
You can always change the aperture angle by manually adjusting the position of the draft shield.

You can clear the aperture angle by either
– entering an aperture < 45° using the numeric keys (e.g., "0") and confirming this entry by pressing the ᴼ/ or ᶜ/ key
or
– by closing the draft shield manually

Important Note:
The aperture angle and the direction in which the draft shield opens remain stored even after you have turned off the display using the ᵒ/ key.
This information will not be erased until you unplug the balance from AC power.

Numeric Entry of an Aperture Angle

The numeric entry of an aperture angle corresponds to a fixed position. The aperture is measured counter-clockwise starting from the closed draft shield position:
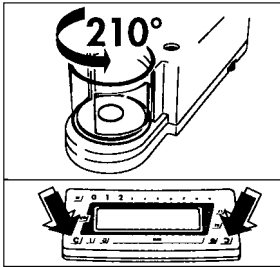
– Enter an aperture angle between 45° and 315° using the numeric keys **(20)**; e.g., ②①⓪
– Confirm this entry by pressing either the ⊃/ or ⊂/ key **(23),** depending on the direction you wish the draft shield to open
– The aperture angle and the direction are now stored for further operation

You can clear the aperture angle by either
– entering an aperture < 45° using the numeric keys (e.g., "0") and storing this entry by pressing the ⊃/ or ⊂/ key

or

– by closing the draft shield manually

Important Note:
The aperture angle and the direction in which the draft shield opens remain stored even after you have turned off the display using the ᵂ/ key. This information will not be erased until you unplug the balance from AC power.
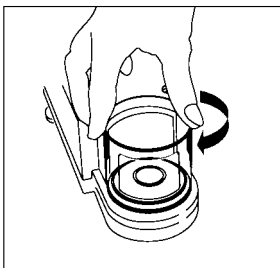
Opening and Closing the Draft Shield Manually

Of course, you can also open and close the draft shield by hand.

Important Note:
An open draft shield will always close automatically if you have not operated the balance for 1 minute. Exception:
– It will not close automatically if you have set menu code 8 8 1 "Automatic draft shield function off" (see part 2, "Balance Operating Menu")

Simple Weighing

Place your sample on the weighing pan **(7)**, and close the draft shield door. Read off the weight indicated on the display **(28)** only after the weight unit ("g", or a different unit selected – see part 2, "Balance Operating Menu") appears as the stability symbol.

Important Note Concerning Verified Balances of Accuracy Class Ⓘ
To avoid measuring errors, the respective air density must be allowed for. The following formula is used to calculate the mass of the sample:

$$m = n_w \; \frac{1 - \varrho_L / 8000 \text{ kg m}^{-3}}{1 - \varrho_L / \varrho}$$

m = mass of the sample
n_w = weight readout
ϱ_L = air density during weighing
ϱ = density of the sample
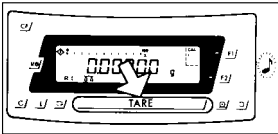
Taring

If you wish to use a container or if the weight display does not indicate 0.000 mg (depending on the display mode or weight unit selected), zero the display before you weigh.

To do so, press <u>TARE</u>/ key **(26)**.

During taring, you can have the fully automatic draft shield function either on or off.

For more information on turning this fully automatic draft shield function on or off by menu code, refer to part 2, "Balance Operating Menu."

Important Note for Verified Balances Approved for Use as Legal Measuring Instruments:
The small circle in the weight display (on the left) shows that the balance is exactly tared to "0" (± 0.25 of a scale interval).

Weighing Range Structure

SuperRange "Single Wide-Range"
(identified by S in the model name MC.....S)

210 g		0.01 mg
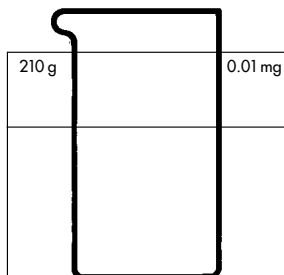
SuperRange models have an extraordinarily high resolution; i.e., the weighing range has a resolution ranging from 100,000 to a few million digits. There is one level of fine readability for the entire weighing range (for example: 0.01 mg).

PolyRange "Multi-Interval"
(identified by P in the model name MC.....P)

210 g		0.05 mg
110 g	0.00 mg	0.02 mg
60 g		0.01 mg
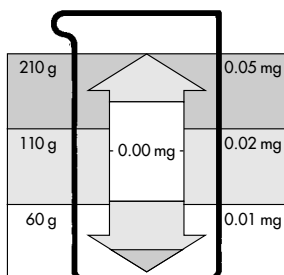
Wide weighing range with multiple levels of accuracy that change as the load increases or decreases

The PolyRange function divides the weighing range into as many as 4 ranges, each with a different readability. In the various ranges, the readability will adjust so that the last numeral of a weight readout is displayed with a resolution of 1, 2 or 5 digits. After you have pressed the tare key **(26),** you will obtain the highest possible resolution, even when the balance is loaded.

Weighing in the IQ-Mode*

(Load-Dependent Readability)
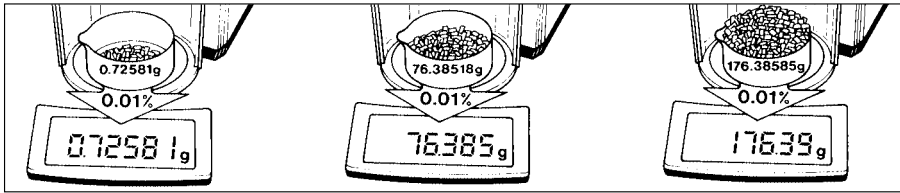
In the IQ-mode, weighing is done with a load-dependent readability of, e.g., 0.01% (for different settings, see part 2, "Balance Operating Menu") throughout the entire weighing range of the balance.
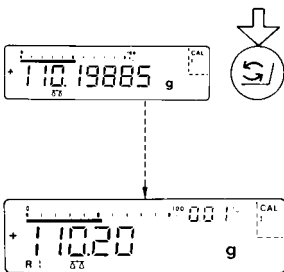
Oftentimes, a display accuracy of 10 mg is sufficient for a load of approx. 110 g. In this case, it makes sense **to select weighing range R 1 with an accuracy of 0.01% by pressing the ⌇/ key (29).** While you are filling up to a target weight, it is certainly easier to work with a target of 110.20 g than with an absolutely accurate readout of 110.19885 g.

* = not with verified models; other settings in the balance operating menu are necessary on model MC 5
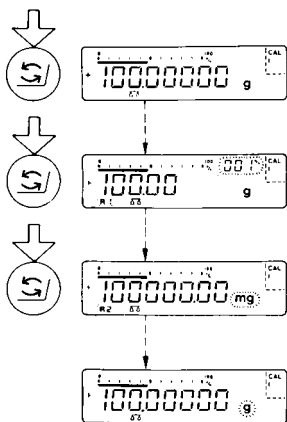
Mass Unit Conversion by Toggling

You can have the weight displayed in milligrams or grams.

To select the weight units one after the other, press the ⑤/ key **(29)** each time.

In addition to milligrams and grams, the standard balances give you a wide variety of other menu-definable international weight unit options.
For more information, refer to part 2, "Balance Operating Menu."
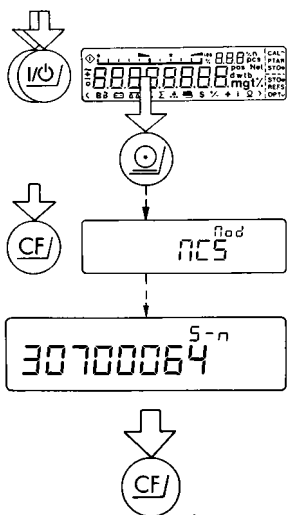
Displaying the Balance Model and Serial Number on the Weight Display

– Turn off the balance display
– Turn it back on
– While all segments are displayed, briefly press the ☺/ key **(24)**

– The balance model is displayed (example: model "MC 5")

– Press the CF/ key **(32)** to have the serial number displayed

– Press CF/ to quit this function

Calibration/Adjustment
and Linearization Functions

During calibration, the span* of your balance
is adjusted to changes in ambient conditions.

Relinearize your balance each time you set it up in
a different area or recalibrate (re-adjust) it when the
ambient conditions change (for example, temperature
or barometric pressure). Even if these conditions are
constant, the balance should be calibrated once
a day. To meet the highest requirements for accurate
weighing, we recommend that you calibrate
the balance before each weighing series or set the
isoCAL self-calibrating function to "ON."

Δ̅Δ̅ : Self-calibrating Function "isoCAL"

The criteria for fully automatic calibration
are as follows:
– Two hours have passed since the balance was
  turned on ("cold start")
– The difference between the current temperature and
  the temperature during the last calibration procedure
  is greater than ± 1° Kelvin
– (Up to) four hours have passed since the last
  automatic calibration

Flashing Δ̅Δ̅ Symbol

If the Δ̅Δ̅ symbol flashes, the balance wants to self-
calibrate. You do not need to interrupt your weighing
series; the balance will wait until you have unloaded
the weighing pan and have not used the balance for
one minute before performing internal self-calibration.
During this procedure, the draft shield must be closed
to ensure that calibration is done correctly. The
symbol flashes until the balance begins self-calibration
or until you activate one of the calibration functions
manually (see next page).

**To turn off the self-calibrating function by menu code,
refer to part 2, "Balance Operating Menu."**

* = The difference between the indication of a weight
    at maximum capacity and the indication at zero

The balance offers you various calibration and linearization functions.

You can interrupt any calibration or linearization procedure by pressing the CF/ key **(32)**.

In the fully automatic mode, the draft shield closes after the F1/ or the TARE/ key has been pressed.

Important Note:

During calibration or linearization, you must observe the following:

– Unload the weighing pan
– Do not disconnect the balance from AC power
– Do not unplug the connecting cable

Important Note to Users of Verified Balances Approved for Use as Legal Measuring Instruments:

Before using your balance as a legal measuring instrument, you must carry out the internal calibration function at the place of installation (see below).

Internal Calibration

CAL Function Using the F1/ Key:

Unload the pan and tare (if necessary, close the draft shield).
When the balance shows a zero readout, press the F1/ key **(21)**.
"C" will now be displayed. The built-in calibration weights are internally applied by servomotor and removed at the end of calibration.

If external interference affects the calibration procedure, you may obtain a brief display of the error message **"Err 02."**
In this case, tare and then press the F1/ key again when a zero readout appears.

An acoustic signal indicates the end of calibration.
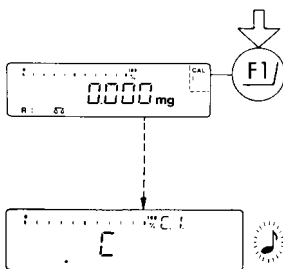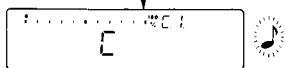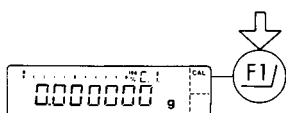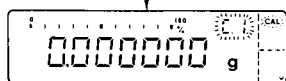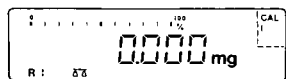
Internal Calibration Using the Tare Key:

Calibrate the balance using the tare key if an application program (such as the tare memory) is assigned to the $\underline{F1}$/ key by menu code in the balance operating menu (see parts 2 and 3).

Press the tare key **(26)** for at least 2 seconds until "**C.I.**" and "**CAL**" are displayed (next to the $\underline{F1}$/ key). Unload the pan and tare (if necessary, close the draft shield).

When the balance displays a zero readout, press the $\underline{F1}$/ key **(21)**.
"**C**" will now be displayed. The built-in calibration weights are internally applied by servomotor and removed at the end of calibration.
If external interference affects the calibration procedure, you may obtain a brief display of the error message "**Err 02.**"
In this case, tare and then press the $\underline{F1}$/ key again when a zero readout appears.

An acoustic signal indicates the end of calibration.

External Calibration
(with Numeric Entry of the Weight 5 g/200 g ±2%)

Use only calibration weights that have tolerances equal to or better than those of accuracy class E2.

How to unlock the access switch on verified balances approved for use as legal measuring instruments:
Remove the protective cap from the rear panel of the computing device and move the menu access switch **(13)** in the direction of the arrow.
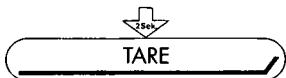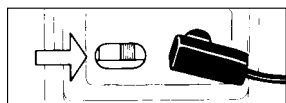
Press the **TARE**/ key **(26)** for at least 2 seconds, until "**C.I.**" and "**CAL**" are displayed (next to the $\underline{F1}$/ key).
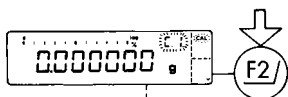
For **"external calibration,"** press the F2/ key **(22)** until **"C.E."** is displayed.

"C.E." stands for **"external calibration."**
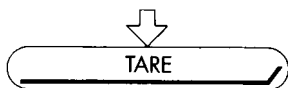
Unload the weighing pan **(7)** and tare (close the draft shield).
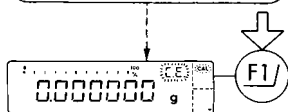
Press the F1/ key **(21)** when a zero readout is displayed. Afterwards, the calibration weight readout will be in grams.
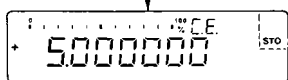
If external interference affects the calibration procedure, you may obtain a brief display of the error message **"Err 02."**
In this case, tare and then press the F1/ key again when a zero readout appears.
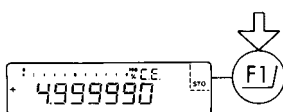
Numeric Entry of a Value Listed on a Weight Certificate (5 g/200 g ±2%)

If you are using a certified calibration weight, enter the exact weight value specified using the numeric keys **(20)**. Then press the F1/ key identified on the display by "STO" to store this value (only possible within the given limits).
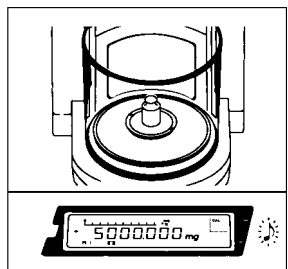
Center the calibration weight on the weighing pan **(7)** and close the draft shield.

An acoustic signal indicates the end of calibration.

Calibration Test

The calibration test is carried out with internal weights as follows:

– MC 210 S and MC 210 P (-0CE)
with approx.   170 g
– MC 410 S (-0CE) with approx.   300 g
– MC 5 (-0CE) with approx.   5 g
– SC 2 (-0CE) with approx.   2 g

Press the tare key **(26)** for at least 2 seconds until "C.I." and **"CAL"** are displayed (next to the F1/ key).
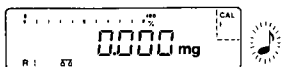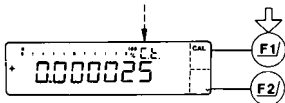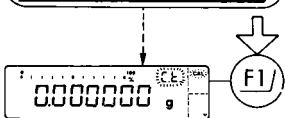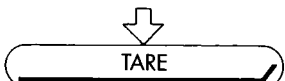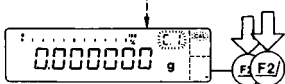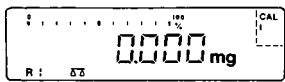
Select the calibration test by pressing the F2/ key **(22)** twice until **"C.t."** is displayed.

Unload the balance and tare (close the draft shield).

"C.t." stands for **"calibration test."**

When the balance displays a zero readout, press the F1/ key **(21)**. The built-in calibration weights are now internally applied by servomotor. Afterwards, the deviation of the momentary weight readout from the target weight (displayed in grams only) is indicated.

If external interference affects the calibration test procedure, you may obtain a brief display of the error message **"Err 02."** In this case, tare and then press the F1/ key again when a zero readout is displayed.

The balance should be adjusted (calibrated) if the deviation in the weight measurement no longer meets the accuracy requirements of your particular application.

F1/ **key:** The balance is automatically calibrated
(see also page 1–31)

or

F2/ **key:** Quits the calibration test

An acoustic signal indicates the end of the sensitivity test.

Important Note:

For the setting "CAL calibration test using the F1/ key" see part 2, "Balance Operating Menu."

Internal Linearization

Press the TARE/ key **(26)** for at least 2 seconds until "**C.I.**" and "**CAL**" are displayed (next to the F1/ key).
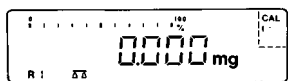
Select "**internal linearization**" by pressing the F2/ key **(22)** several times until "**L.I.**" is displayed.

Unload the balance and tare (close the draft shield).
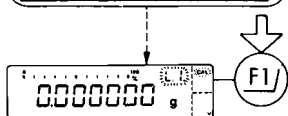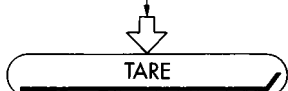
"**L.I.**" stands for "**internal linearization**."

When a zero readout is displayed, press the F1/ key **(21)**. "**C**" will now be indicated. The built-in weights are internally applied one after the other by servomotor, and the balance is automatically linearized.
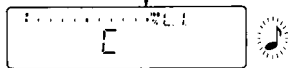
If external interference affects the linearization procedure, you may obtain a brief display of the error message "**Err 02**." in this case, tare and then press the F1/ key again when a zero readout appears.

An acoustic signal indicates the end of linearization.

Important Note:

The balance automatically self-calibrates after each internal linearization procedure.

Data Interface
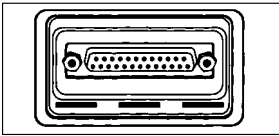
If you wish to record weight data using a Sartorius Data Printer, plug the printer connector into the interface port **(14)** of the balance. You do not need to adjust any settings.

Important Note for Verified Balances Approved for Use as Legal Measuring Instruments:

When using the balance as a legal measuring instrument, you may connect to it only auxiliary devices that are legally permitted.

Make sure to unplug the balance from the power supply **(12)** before you connect or disconnect a peripheral device (printer or PC) to or from the interface port **(14)**.

To print data on hard copy or output them on the screen of an on-line computer, press the ⌑/ key **(24)**.

```
001:      + 1608,628 mg
002:      +  608,715 mg
003:      +  722,744 mg
004:      + 1722,655 mg
```

For information about special data output parameters, see part 2, "Utilities" of the Balance Operating Menu.

For details on the data interface, see part 4, "Interface Description."

Interfacing Devices with the Balance

Please note that the interface port is electrically connected to the protective grounding conductor of the balance housing. The interface cables supplied as standard equipment are shielded, and both ends of each cable are electrically connected to the connector cases.
This connection may result in interference caused by ground loops or by transient currents if you have grounded the housing or connected the protective grounding conductor for AC power. If necessary, connect an equipotential bonding conductor to the balance.
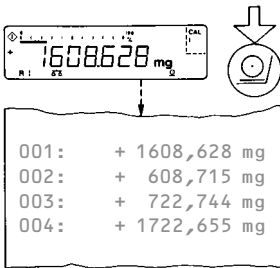
Below-Balance Weighing

A port with a below-balance weighing hanger is available on the bottom of the balance.
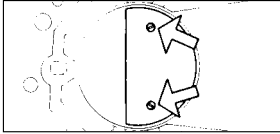
To hook a sample on the hanger, open the below-balance port by removing the two screws from the bottom of the balance and detaching the cover plate and gasket.
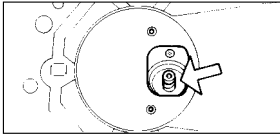
Now you can attach a sample using a suspension wire, for example. You also have to install a shield to protect against drafts.

Important Note for Verified Balances Approved for Use as Legal Measuring Instruments:
The below-balance weighing port may not be opened when an approved balance is being operated as a legal measuring instrument.

Fastening an Antitheft Locking Device
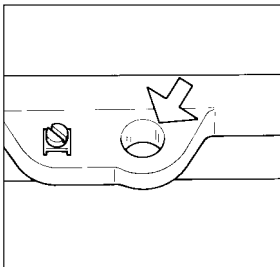
Use the lug **(16)** located on the rear panel of the weighing cell to secure the weighing cell with a chain or a lock at the place of installation.

Troubleshooting Guide

Problem...	Causes...	Solution
No segments appear on the weight display **(28)**	– No AC power available – The power supply/AC adapter is not plugged in	– Check the AC power supply – Plug in the power supply/AC adapter
The weight display shows **"Err 235"**	– The connecting cable is not plugged in correctly – The computing device or the weighing cell was switched with a unit from another balance	– Plug in the female connectors correctly and secure them by tightening the screws – Connect the units that belong together
The weight display shows **"Err 54"** or **"L"**	– The weighing pan **(7)** is not in place	– Position the pan and then press down on it gently while turning it slightly to the left and right
The weight display shows **"H"**	– The load exceeds the capacity of the balance	– Unload the balance
The weight display shows **"Err 01"**	– The value that should appear cannot be displayed	– Set the appropriate code in the balance operating menu
The weight display briefly shows **"Err 02"**	– The display did not show a zero readout when the ⏚/ key **(21)** was pressed to calibrate – The balance is loaded	– Press the TARE/ key first, then press the ⏚/ key again – Unload the balance
The weight display briefly shows **"Err 03"** or **"Err 04"**	– The balance is in the warmup phase – The weighing system is affected by drafts or vibrations	– After plugging the balance into AC power, condition it for 12 hours – Set up the balance in another area
The weight display shows **"Err 07"**	– The function activated is not allowed on a verified balance used as a legal measuring instrument	– Unlock the menu access switch

Problem...	Causes...	Solution
The special code **"C"** does not go out on the weight display **(28)**	– The balance is not ready to calibrate or is in the warmup phase	– After plugging the balance into AC power, allow for at least 2 hours' warmup
	– The weighing system is affected by drafts or vibrations	– Access the menu to select the correct code for the weighing environment
	– The draft shield is not closed	– Check draft shield function and close
	– The port for the below-balance weighing hanger is open	– Fasten the cover plate to close the port for below-balance weighing
The special code **"◊"** does not go out on the weight display	– None of the keys has been pressed since the balance was turned on	– Press a key
The weight readout changes constantly	– Unstable ambient conditions	– Set up the balance in another area
	– Too much vibration or the balance is exposed to a draft	– Access the menu (see part 2) to select the correct code for the weighing environment
	– The draft shield is not completely closed	– Close the draft shield
	– A foreign object is caught below the pan	– Remove the foreign object
	– The port for the below-balance weighing hanger is open	– Fasten the cover plate to close the port for below-balance weighing
	– The sample does not have a stable weight (absorbs moisture or evaporates)	
The weight readout is obviously wrong	– The balance is not calibrated	– Calibrate (see pp. 1–30 f.)
	– The balance was not tared before weighing	– Tare before weighing
	– The air bubble in the level indicator **(10)** is not within the circle	– Level the weighing cell (see page 1–15)

Care and Maintenance

Servicing

Regular servicing by a Sartorius service technician will extend the service life of your balance. Sartorius can offer you service contracts with your choice of regular maintenance intervals ranging from 1 month to 2 years.
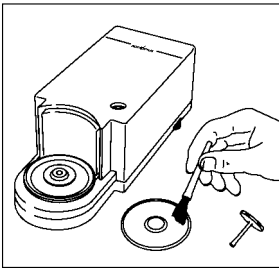
Cleaning the Balance Housing and the Draft Shield

Before cleaning the balance, unplug the power supply from the wall outlet.

Please do not use any aggressive cleaning agents (solvents or similar agents). Instead, use a piece of lint-free cloth which has been wet with a mild detergent. Make sure that no liquid enters the balance housing. After cleaning, wipe down the balance with a soft, dry piece of cloth.
To clean the draft shield, remove it from the weighing cell. Clean the draft shield with a commercially available glass cleaning agent or in a dishwasher.

Cleaning the Weighing Chamber
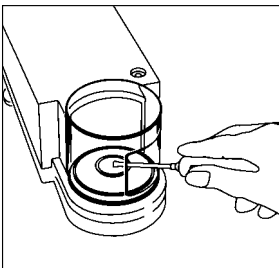
Carefully remove spilled powder from underneath the protective disk **(8)** by using a small car vacuum cleaner with a mini-hose attached.
Do not clean the weighing chamber by blowing off powder from the balance components!

To remove liquid spills, use blotting paper.
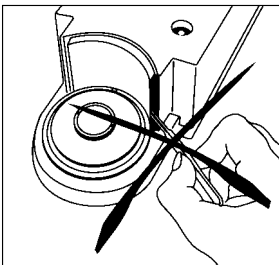
Do not insert a pair of forceps or any other object behind the draft shield closing plate.

Important Note:

The weighing system is hermetically sealed from the draft shield closing plate area so that dirt cannot enter.

Safety Precautions

If there is any indication that safe operation of the balance with the power supply/AC adapter is no longer warranted, turn off the power and unplug the equipment from AC power immediately. Lock the equipment in a secure place to ensure that it cannot be used for the time being.

Safe operation of the balance with the power supply/AC adapter is no longer ensured when
– there is visible damage to the power supply
– the power supply no longer functions properly
– the power supply has been stored for a relatively long period under unfavorable conditions

In this case, notify your nearest Sartorius Service Center or the International Service Support Unit based in Goettingen, Germany. Only service technicians who have access to the required maintenance manuals are allowed to perform maintenance and repairwork on the equipment.

We recommend that the balance together with the power supply be inspected by a qualified Sartorius service technician according to the following checklist:
– Insulation resistance > 7 megohms measured with a constant voltage of at least 500 V at a 500 kohm load
– Equivalent leakage current < 0.05 mA measured by a properly calibrated multimeter

The duration and number of measurements should be determined by a qualified Sartorius service technician according to the particular ambient and operational conditions for the power supply. Such inspection should be done at least once a year.

Balance Operating Menu

The Sartorius MC 1 Balance can be adjusted to meet your special requirements; e.g., to weigh in various units of measure, adapt to unfavorable conditions and process weight data for a variety of applications.

In the operating menu, you can define how your balance will adapt to ambient conditions, and also how it will work to meet your needs.

The factory-set menu codes are identified by an "*." You can select the functions not identified by an "*" by setting the respective menu code.

Important Note Concerning Verified Balances Approved for Use as Legal Measuring Instruments:

The balance operating menu can also be changed when the balance is being used as a legal measuring instrument. Codes that are not permitted for operation of the balance as a legal measuring instrument are blocked or not displayed as a rule. After verification, the balance operating menu cannot be locked with the menu access switch (-L- not displayed).

Changing a Menu Code Setting

To select specific functions, you will need to set the respective menu code.

There are three steps to changing a code:

- **Accessing the menu**
- **Setting a code**
- **Confirming and storing this code**

For setting menu codes, the keys have special functions. To set a code, use the four keys which are defined on the display as arrow points to indicate the direction:
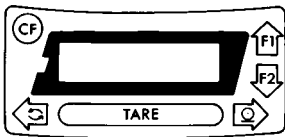
< ≤/ and > ⊙/	= Move to the left or right
∧ F1/ and ∨ F2/	= Increase or decrease a number by one with each press
TARE/	= Confirm a code setting
CF/	= Store a code setting and exit the menu

Now try changing the weight unit in the second weighing range from grams to carats "ct," code **3 1 4**.

Accessing the Menu (Example Code 3 1 4)
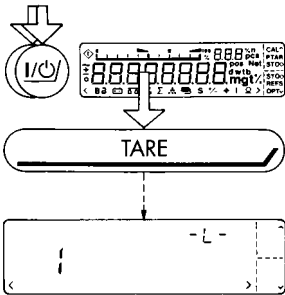
- Turn the balance off
- Turn it back on again

- While all segments are displayed, briefly press the TARE/ key **(10)**.

- If **-L-** is displayed, unlock the menu as follows:
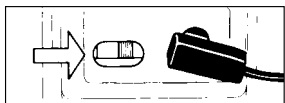
- Remove the protective cap located on the left-hand side of the balance's/electronic computing device's rear panel to expose the menu access switch
- Move the switch in the direction of the arrow
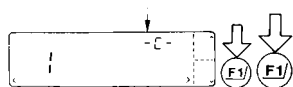
– Press the F1/ key to change the left-hand number to "3"
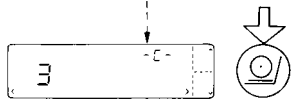
– Press ⊙/ to move to the middle number
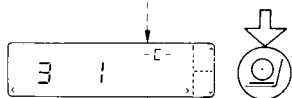
– Now press the ⊙/ key to move to the right-hand number (When you move to the right-hand number, the previously set numeric code will be indicated).

– Press the F1/ key to change the right-hand number to "4"
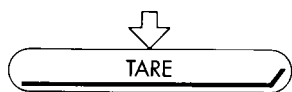
Confirm the Code Setting

– You must press the TARE/ key in order to confirm the code you have just set. This is indicated by the "o" after the code.
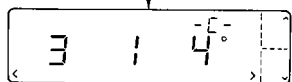
– Press CF/ to **store the new menu code setting**

The current menu code setting in the balance operating menu is identified by a small "o" after the last number. When you access the operating menu, the previously set numeric code will be displayed after you have selected the left-hand and middle numbers, which means the entire menu code setting will be displayed. This makes it easy for you to check the previously set menu codes.

If you would like to change several menu code settings, you do not have to press CF/ after each change to exit the balance operating menu.

Please do not forget to relock the balance operating menu. The "**-L-**" indicates that it is currently locked:

To use the locking function, make sure code **8 1 2**
is set in the balance operating menu.
If code **8 1 1** is set, the menu access switch will
not lock.
In this case, "**-C-**" will be displayed whenever you
access the menu:

Undoing All Menu Code Changes – Reset Function

The reset function lets you undo all menu code
changes, which means that you will obtain the original
factory-set menu codes indicated by an "*" so that
your balance will operate according to them.

To use this function, you will need to select
code 9 – – 1°. See the previous pages for information
on confirming and storing a menu code setting.

The charts on the next pages give just a small
sampling of the code options available for
the balance operating menu. These options include
standard balance operating parameters, utilities
for printouts or data transfer and additional functions.

Balance Operating Parameters

Adapting the Balance to Ambient Conditions

To adapt your balance to ambient conditions, you may need to change the response time (see the "Specifications").

	Code		
Very stable conditions	1	1	1
Stable conditions	1	1	2*
Unstable conditions	1	1	3
Very unstable conditions	1	1	4

Standard Weighing Mode – Manual Filling Mode

You can optimally adapt your balance to meet either of these requirements.
In the manual filling mode, the display compensates for fluctuations of the load on the balance so that you obtain a steadier readout.

	Code		
Standard weighing mode	1	2	1*
Manual filling mode	1	2	2

Stability Range

When the stability symbol is displayed, the weight readout is stable within the defined range.

Readout is stable within +/−	Code		
0.25 digit	1	3	1
0.5 digit	1	3	2
1 digit	1	3	3*
2 digits	1	3	4*
4 digits	1	3	5
8 digits[1]	1	3	6

* = factory setting; depends on the balance model in some cases
[1] = not applicable to verified balances approved for use as legal measuring instruments

Stability Symbol Delay

This setting allows your balance to compensate for individual interfering factors which slowly subside, such as turbulent air currents generated within the weighing chamber.

	Code		
No delay	1	4	1
Short delay	1	4	2*
Long delay	1	4	3
Extremely long delay	1	4	4

Tare Parameter

You can define when the balance will perform the taring operation:

	Code**		
At any time	1	5	1
Not until the readout is stable	1	5	2*

Auto Zero Function

When this zero tracking function is activated, any changes off the zero readout that are equal to a defined fraction of digits per second are automatically tared. In other words, it ensures a stable zero.

	Code		
Auto Zero on	1	6	1*
Auto Zero off	1	6	2

* = factory setting
** = setting does not apply to verified balances approved for use as legal measuring instruments

Weighing in Three Ranges on Standard Balances

The toggle key ⌒/, lets you switch back and forth between two weighing ranges, R1 and R2.

If the menu code is set for three ranges, press the " ⌒/ " key each time to toggle to a different range.

Selecting the Number of Ranges

	Code		
Block the ⌒/ key/one weighing range	2	1	1
Two weighing ranges	2	1	2*
Three weighing ranges	2	1	3*

	ID symbol displayed 1st range	2nd range	3rd range
Two weighing ranges	⊼⊼ **	R1 ⊼⊼	
Three weighing ranges	⊼⊼ **	R1 ⊼⊼	R2 ⊼⊼

Weight Units

The "initial weight unit" is the unit in which your balance will weigh the moment you turn it on. This unit is defined in the 1st range. You can select a different unit for each weighing range by setting the appropriate menu code.

*   = factory setting; depends on the balance model in some cases
** = The standard weighing range automatically displayed when you turn on the scale is identified only by the scale symbol in the display.

Overview of the Weight Units

	Symbol	Code 1st range			2nd range			3rd range		
Grams	o	1	7	1	3	1	1	3	3	1
Grams	g	1	7	2*	3	1	2*	3	3	2
Kilograms	o	1	7	3	3	1	3	3	3	3
Carats	ct	1	7	4	3	1	4	3	3	4
Pounds	lb	1	7	5	3	1	5	3	3	5
Ounces	oz	1	7	6	3	1	6	3	3	6
Troy ounces	ozt	1	7	7	3	1	7	3	3	7
Hong Kong taels	tl	1	7	8	3	1	8	3	3	8
Singapore taels	tl	1	7	9	3	1	9	3	3	9
Taiwanese taels	tl	1	7	10	3	1	10	3	3	10
Grains	gr	1	7	11	3	1	11	3	3	11
Pennyweights	dwt	1	7	12	3	1	12	3	3	12
Milligrams	mg	1	7	13*	3	1	13	3	3	13*
Parts/pound	o	1	7	14	3	1	14	3	3	14
Chinese taels	tl	1	7	15	3	1	15	3	3	15
Mommes	m	1	7	16	3	1	16	3	3	16
Austrian carats	o	1	7	17	3	1	17	3	3	17
Tola	t	1	7	18	3	1	18	3	3	18
Baht	b	1	7	19	3	1	19	3	3	19
Mesghal	m	1	7	20	3	1	20	3	3	20

Codes 1 7 1, 3 1 1 and 3 3 1 are reserved for programming special units to meet the needs of customized applications. The standard, factory-set unit is grams.
In the display, you will see "o" as the stability symbol for a stable readout, just as for kilograms.

* = factory setting; depends on the balance model in some cases

Some unit symbols printed on hard copy or output on a computer screen will differ from the way they are shown on the balance display:

This applies to code numbers
ending with

3 = kg
8 = tlh
9 = tls
10 = tlt
11 = GN
14 = /lb
15 = tlc
16 = mom
17 = K
18 = tol
19 = bat
20 = MS

Weighing in Two Ranges on Verified Balances Approved for Use as Legal Measuring Instruments

The toggle key, ⊴/, lets you switch back and forth between two weighing ranges, provided you are using the factory-set menu code.

Selecting the Number of Ranges

	Code		
Block the ⊴/ key	2	1	1
Two weighing ranges	2	1	2*

Weight Units

Overview of the Weight Units

	Symbol	Code					
		1st range			2nd range		
Grams	g	1	7	2*	3	1	2*
Milligrams	mg	1	7	13	3	1	13

* = factory setting

Display Modes for Standard Balances

You can select the display mode that best meets your individual requirements.

Last Numeral Blanked When the Load Changes

As the load on your balance changes, the display resolution is reduced
by a factor of 10 so that you will obtain a faster and more stable readout.
Once the load has stabilized, the readout is shown again with the full display
accuracy, which means the last numeral is displayed.

Display Accuracy

You can define the level of accuracy by changing the display increments, also
called "scale intervals" (of the last numeral). The display increments possible are
as follows:
1, 2, 5, 10, 20, 50, etc.
Starting with the basic increments of a weight unit, the display accuracy can be
reduced by as many as three levels so that you will obtain a faster readout.
This accuracy is reduced in relation to the selected basic increment of the weight
unit. Example: weight unit "ct" for carats
(5 increments) with code setting 1 8 3 → 10 increments. To make this concept
easier to understand, the three levels are designated as "rounding factors"
in the tables summarizing the various menu code settings.

IQ-Mode
(Load-Dependent Readability)
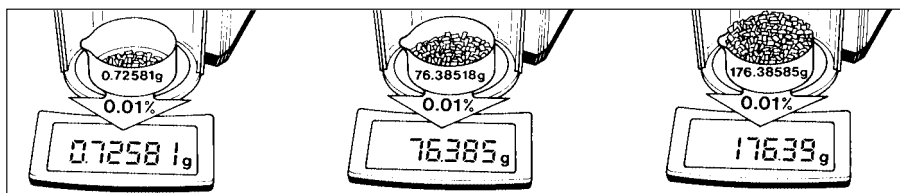
In the IQ-mode, weighing is done with a menu-definable, load-dependent
readability throughout the entire weighing range of your balance. In the process,
the display resolution of the last digit of the weight readout changes in increments
of 1, 2, 5, 10, 20, etc., in proportion to the weight of the sample.

This mode for adapting the display accuracy enables you to weigh with a constant
relative accuracy between 1% and 0.01% over the entire weighing range
of your balance. Select the load-dependent display accuracy independently for
each of the three weighing ranges. The accuracy selected is shown in the top
right-hand corner of the application display field.

PolyRange Function (application for single-range balances)

The PolyRange function divides a single weighing range into as many as
4 ranges, each with a different readability. In the various ranges, the readability
will adjust so that the last numeral of a weight readout is displayed with
a resolution of 1, 2, 5 or 10 digits (10 digits = only the next to the last numeral
of the readout will change; the last numeral is blanked).
The PolyRange function makes filling easier because the readability becomes
slightly coarser as the load increases and you will not immediately lose an entire
place of readability.
Press the tare key at any range level to restore the full resolution of the first range,
even when the balance is loaded.

				Code				
Display mode	1st range			2nd range			3rd range	
Highest possible accuracy	1	8	1*	3	2	1*	3	4	1*
Last numeral blanked when load changes	1	8	2*	3	2	2	3	4	2*
Rounding factor 2	1	8	3	3	2	3	3	4	3
Rounding factor 5	1	8	4	3	2	4	3	4	4
Rounding factor 10	1	8	5	3	2	5	3	4	5
1.0% accuracy	1	8	6	3	2	6	3	4	6
0.5% accuracy	1	8	7	3	2	7	3	4	7
0.2% accuracy	1	8	8	3	2	8	3	4	8
0.1% accuracy	1	8	9	3	2	9	3	4	9
0.05% accuracy	1	8	10	3	2	10	3	4	10
0.02% accuracy	1	8	11	3	2	11	3	4	11
0.01% accuracy	1	8	12	3	2	12*	3	4	12
PolyRange function	1	8	13	3	2	13	3	4	13

* = factory setting, depends on the balance model in some cases

Display Modes for Verified Balances Approved for Use as Legal Measuring Instruments

You can select the display mode that best meets your individual requirements.

Last Numeral Blanked When the Load Changes

As the load on your balance changes, the display resolution is reduced by a factor of 10 so that you will obtain a faster and more stable readout.
In the process, the last numeral is blanked until the load stabilizes. Once the load has stabilized, the readout is shown again with the full display accuracy, which means the last numeral is displayed.

Display mode	Code 1st range			2nd range			3rd range		
Highest possible accuracy	1	8	1*	3	2	1*	–		
Last numeral blanked when load changes	1	8	2	3	2	2	–		
Rounding factor 10	–			–			3	4	5*

IQ-Mode
(Load-Dependent Readability)

The IQ-mode does not apply to EC type-approved balances verified for use as legal measuring instruments.

* = factory setting

Calibration Functions on Standard Balances

Select the appropriate menu code to define the access status for each of the calibration functions, which are activated by holding down the <u>TARE</u>/ key for a few seconds.

If the menu access switch is unlocked ("accessible" status indicated by -ᴄ- after you have accessed the balance operating menu), the "external calibration" function will be accessible even though you have set the menu code 1 9 2 for "access denied."

External calibration	Code		
Accessible	1	9	1*
Access denied	1	9	2

Internal calibration	Code		
Accessible	1	10	1*
Access denied	1	10	2

Calibration test	Code		
Accessible	1	11	1*
Access denied	1	11	2

External Linearization

The linearization weights to be loaded are displayed on the balance one after the other in increasing order. The balance must be re-calibrated after external linearization.

Important Note:
If you use linearization weights that differ from the values displayed, this will cause errors.

External linearization	Code		
Accessible	1	12	1
Access denied	1	12	2*

Internal linearization	Code		
Accessible	1	13	1*
Access denied	1	13	2

* = factory setting

2–14

Multiple Calibration Mode

The calibration value is calculated from the average of the individual calibration procedures. You can use the "**multiple calibration mode**" for both internal and external calibration. The number of calibration procedures is indicated in the 3rd place of the application display field (e.g., "C.I.**3**").

Important Note:

If "**Err 04**" is briefly displayed, the calibration values deviate too much from one another. This means the calibration value measured is not stored, and the calibration procedure will be repeated.

Multiple calibration mode	Code		
Off	1	14	1*
On	1	14	2

Self-Calibration "isoCAL" and Linearization

	Code		
Off	1	15	1
Calibration status displayed only [1]	1	15	2
Self-calibration "isoCAL" on	1	15	3*
Self-calibration "isoCAL" and linearization on	1	15	4

[1] = The symbol "ΔΔ" flashes in the display until you press the appropriate key to activate one of the calibration functions

CAL Using ᴱᴵ/

You can activate the "**internal calibration**" function anytime at the touch of the ᴱᴵ/ key (factory setting).

Function of the ᴱᴵ/ key	Code		
Acces denied	2	2	1
Internal calibration "CAL I"	2	2	5*
Calibration function "CAL T"	2	2	6

* = factory setting

Calibration Functions on Verified Balances Approved for Use as Legal Measuring Instruments

Select the appropriate menu code to define the access status for each of the following calibration functions, which are activated by holding down the TARE/ key for a few seconds:

– External calibration   C.E.
– Internal calibration   C.I.
– Calibration   C.t.
– Internal linearization   L.I.
– Air density determination   A.d. (see part 3, "Application Programs")

However, if the menu access switch is unlocked ("accessible" status indicated by -ᴄ- after you have accessed the balance operating menu), the "external calibration" function will be accessible even though you have set the menu code 1 9 2 for "access denied."

External calibration	Code**
Accessible	1 9 1
Access denied	1 9 2*

Internal calibration	Code
Accessible	1 10 1*
Access denied	1 10 2

Multiple Calibration Mode

The calibration value is calculated from the average of the individual calibration procedures. You can use the "**multiple calibration mode**" for both internal and external calibration. The number of calibration procedures is indicated in the 3rd place of the application display field (e.g., "C.I.**3**").

Important Note:
If "**Err 04**" is briefly displayed, the calibration values deviate too much from one another. This means the calibration value measured is not stored, and the calibration procedure will be repeated.

Multiple calibration mode	Code
Off	1 14 1*
On	1 14 2

*   = factory setting
** = setting does not apply to verified balances approved for use as legal measuring instruments

Self-Calibration "isoCAL" and Linearization

	Code		
Off (restricted temperature range)	1	15	1[1]
Self-calibration "isoCAL" on	1	15	3*
Self-calibration "isoCAL" and linearization on	1	15	4

[1] = With the appropriate modifications, your local Sartorius authorized service technician can make code 1 15 1 accessible. Afterwards, you may use the balance only in the legally restricted temperature range from +15 °C to +25 °C.

CAL Using ⌐!/

You can activate the "**internal calibration**" function anytime at the touch of the ⌐!/ key (factory setting).

Function of the ⌐!/ key	Code		
Access denied	2	2	1
Internal calibration	2	2	5*
Calibration	2	2	6

* = factory setting

Utilities for Printouts or Data Transfer

The balance operating menu lets you define the various parameters for data output. For information on the data formats and for interfacing a computer or a different peripheral device, see part 4, "Interface Description."

Data Output Parameter

This parameter is coupled with the stability parameter; stability = stable readout or no motion is detected

Print on request = data is output only when the print key, ⌷/, is pressed
or a software command is received
Auto print = continuous, automatic data output

	Code		
Print on request regardless of stability	6	1	1
Print on request after stability, with storage of the function	6	1	2*
Print on request at stability, without storage of the function	6	1	3
Auto print regardless of stability	6	1	4
Auto print at stability	6	1	5

Automatic Data Output

You can stop and start automatic data output by pressing the print key, ⌷/.

	Code		
Start/stop auto print using the ⌷/ key	6	2	1
Auto print not stoppable	6	2	2*

* = factory setting

Data Output at Defined Intervals

You can reduce the volume of data in the "auto print" mode by defining the interval at which data will be output automatically. This auto print interval is based on the number of times the display is updated.

Auto print interval	Code		
1 display update	6	3	1*
2 display updates	6	3	2
5 display updates	6	3	3**
10 display updates	6	3	4**
20 display updates	6	3	5**
50 display updates	6	3	6**
100 display updates	6	3	7**

Automatic Taring after Data Output

This convenient setting lets you checkweigh a series of samples or products without having to unload the balance after each weighing operation.

This means less work for you:

– the sample remains on the pan after the weight readout has been printed or transferred to an on-line computer
– the balance is tared automatically after the weight readout has been printed or transferred to an on-line computer
– you simply load the next sample or part

Automatic taring after data output	Code		
Data output without automatic taring	6	4	1*
Data output with automatic taring	6	4	2

*   = factory setting
** = not applicable for MC 210 S-0CE, MC 210 P-0CE, MC 410 S-0CE

Data ID Codes

To help you identify weights, piece counts, percentages, etc., a code letter
is printed or displayed in front of these values.
For example, an "N" printed or displayed before a weight value identifies
it as a net weight. If you set the code for "without data ID code," only net weights,
results in percent, and counting results will be output. The ID code increases the
data output format from 16 to 22 characters for each weight readout.
You will find the data ID codes of a particular application program listed
in the corresponding description.

ID code for data output	Code		
Without	7	2	1*
With	7	2	2

* = factory setting

Additional Functions

Menu Access Function

You can define the function of the menu access switch by setting the code for the balance operating menu to "accessible." In this setting, "-C-" will be displayed on your balance whenever you access the menu.

Access to the balance operating menu	Code		
Accessible	8	1	1
Depends on setting of menu access switch	8	1	2*

Beep Tone (Acoustic Signal)

Acoustic signal	Code		
On	8	2	1*
Off	8	2	2

Blocking the Function Keys

You can block all function keys on the balance (except for ⏻).

Key functions	Code		
Accessible	8	3	1*
Blocked	8	3	2

* = factory setting

Blocking the Numeric Keys

You can block the numeric keys by setting the appropriate menu code.

Numeric keys	Code		
Blocked	2	5	1*
Accessible	2	5	2

Important Note:

A control command can be input via the balance interface to block the function and numeric keys (except for ⏻). For more information, see part 4.

Power-On Mode

Depending on the operating mode – line current, battery operation or continuous operation – you can change the power-on mode of your balance. The factory setting is: (power) off —> on <—> standby.

In the setting "toggle between on and standby," the balance power will turn back on automatically after a power failure has occurred, or after you have disconnected your balance temporarily from line current.

In the setting "automatic power-on," the balance will turn back on automatically after a power failure has occurred or after the balance has been disconnected, then reconnected to line current. In this setting, the balance can no longer be turned off by the ⏻ key.

Power-on mode	Code		
(Power) off —> on <—> standby	8	5	1*
On <—> standby	8	5	3
Automatic power-on	8	5	4

Display Backlighting

Display backlighting	Code		
On	8	6	1*
Off	8	6	2

* = factory setting

Fully Automatic Draft Shield Function

You can define the fully automatic draft shield function to meet the most diverse requirements. After you have pressed a function key (or after a control command has been received – see part 4, "Interface Description"), the draft shield will close automatically and the balance will then perform the particular function activated by the key. If code 8 8 2 or 8 8 3 is set, the draft shield will open once the function selected has been performed. In addition, when codes 8 8 2 through 8 8 5 are set, the draft shield closes automatically if the balance has not been used for more than one minute.

To be on the safe side for automatic operation of the balance with a robot, you should turn off the fully automatic draft shield function (code 8 8 1).
The draft shield status should always be polled for operation with a robot (see part 4, "Interface Description").

The draft shield operates automatically for the following functions:

– powering on the balance (ᴵ/⏻/ key)

– taring once the balance has stabilized (TARE/ key)

– printing on request after stability (⌷/ key)

– starting all calibration functions (F1/ key)

– using the tare memory once the balance has stabilized (F1/ key) –
   see also part 3, "Application Programs"

– storing weights during differential weighing and backweighing, weighing in
   percent and counting (F2/ key) – see also part 3, "Application Programs"

– storing weights during over/under checkweighing (F1/ key) –
   see also part 3, "Application Programs"

Automatic draft shield function	Code		
Off	8	8	1
Close draft shield – perform function – open draft shield	8	8	2
Close draft shield – perform function with stability symbol delay – open draft shield	8	8	3
Close draft shield – perform function	8	8	4*
Close draft shield – perform function with stability symbol delay	8	8	5

Display Accuracy with the Draft Shield Automatically Opened or Manually Adjusted

You can define the display accuracy for the automatically opened or manually adjusted draft shield by changing the increments, also called "scale intervals" (of the last numeral). The display increments possible are as follows: 1, 2, 5, 10, 20, 50, etc.
To make this concept easier to understand, the six levels are designated as "rounding factors" in the table summarizing the various menu code settings.

Display accuracy	Code		
Highest possible accuracy	8	9	1*
Rounding factor 2	8	9	2
Rounding factor 5	8	9	3
Rounding factor 10	8	9	4*
Rounding factor 20	8	9	5
Rounding factor 50	8	9	6
Rounding factor 100	8	9	7**

* = factory setting
** = does not apply to verified balances approved for use as legal
       measuring instruments

ISO/GLP-compliant Printout or Record

Application:
Use of the balance in quality assurance systems and in areas subject to compliance with ISO, GLP, GMP and EN, etc.

The balance can record all completed calibration/adjustment operations and output data in compliance with the requirements of Good Laboratory Practice (GLP) and ISO. The balance, interfaced with a data printer or a computer, creates a document that records the date, time, serial number and model number, making it possible to clearly trace data to the balance that generated it and the time at which it was generated.

Select the ISO/GLP printout/record mode by setting the respective code in the balance operating menu.

ISO/GLP-compliant printout/record mode	Code
Off	8 10 1*
Only for calibration and linearization functions	8 10 2
Always on for calibration and weighing functions	8 10 3

The following menu code must be set in order to obtain an ISO/GLP-compliant printout/record:

With data ID code	7 2 2

⚠ **Important Note:**
ISO/GLP-compliant printouts/records will not be output if the factory setting 7 2 1 "without data ID code" is selected. When the "auto print" data output parameter (menu code 6 1 4 or 6 1 5) is set, only calibration and linearization functions are printed/recorded.

* = factory setting

Printout/Record for Calibration and Linearization Functions (menu code 8 10 2)

A printout or record is generated only at the end of the following functions:

– all calibration operations
– all linearization operations
– air density determination (see part 3, "Application Programs")

The printout of the record can have the following lines:

```
--------------------
MC1 -   Sartorius        : Balance family and manufacturer
Model          MC5       : Balance model
S/N    030800046         : Serial no. of the balance
Id         4-32-1        : ID no. (e.g., for identifying
                             a workstation/operator)
--------------------
Date : 30-Jul-95         : Current date
Start:  10:05:30         : Time at which the application started
Cal. :      Test         : Calibration mode (in this case, "calibration")
Diff.:- 0.000013 g       : Data generated during the calibration test
Cal. :    Intern         : Calibration mode (in this case,
                             "internal calibration")
Stat.:  Complete         : Status comment for calibration or
                             linearization functions
End  :  10:05:45         : End of application
Name :                   : Field for signature of the operator responsible
--------------------
Set. :  5.000000 g       : Calibration weight (only for "external
                             calibration")
Set. :     1.175 kg/     : Air density
Cal. :       Air
```

Data Printout/Record (menu code 8 10 3)

To have a data record printed out, perform the following:

– Press ⟲/ to output the printout heading and the first value (after you have turned on the balance or cleared a function by pressing CF/)

– Press ⟲/ to output additional data

– To end printout generation and recording of data, press the CF/ key (generation of an ISO/GLP-compliant printout or record is also ended when a calibration or linearization operation is started)

During data printout, the print symbol ⟲/ appears on the display of the balance.

The printout of the record can have the following lines:

```
--------------------
MC1 -   Sartorius     : Balance family and manufacturer
Model         MC5     : Balance model
S/N     030800046     : Serial no. of the balance
Id        4-32-1      : ID no. (e.g., for identifying
                          a workstation/operator)
--------------------
Date : 30-Jul-95      : Current date
Start:  10:05:30      : Time at which the application started
Ser. :                : Field for entering the project number
N       +    4.490 mg : Measured values/weights
N       +   14.486 mg
N       +   53.350 mg
End  :  10:05:45      : End of application
Name :                : Field for signature of the operator responsible
--------------------
```

Data Printout/Record for Application Programs (menu code 8 10 3)

For application programs, the reference data (parameters) can be included in the printout/record.

Automatic output of the reference data (parameters)	Code		
Off	7	1	1*
Reference %/qty. and reference weight	7	1	2
Reference weight only	7	1	3

You can also add the reference data to the printout/record later by pressing $\underline{i}$/ (information function), $\underline{\circ}$/ and then either the $\underline{F1}$/ or $\underline{F2}$/ key.

To have data printed out, perform the following:

– Press the $\underline{F1}$/ or $\underline{F2}$/ key to output the printout heading and reference data
   (the reference data will be stored at the same time)
or
– Press the $\underline{\circ}$/ key to output the printout heading and the first value

If you input and store new references while an ISO/GLP-compliant record is being printed out, the new reference data will be output. If you enter different data before generation of an ISO/GLP-compliant record is started, the printout heading and the reference data will automatically be printed once you press $\underline{\circ}$/. Then the measured value will be output.

– Press $\underline{\circ}$/ to output weighing data

– Press the $\underline{CF}$/ key to end printout generation (generation of an ISO/GLP-compliant
   printout also ends once a calibration or linearization operation has been started)

– Then press the $\underline{CF}$/ key to clear the reference data for the application programs

During data printout, the print symbol $\underline{\circ}$ appears on the display of the balance.

* = factory setting

2–28

The printout of the data record can have the following lines:

```
---------------------
MC1 -   Sartorius      : Balance family and manufacturer
Model           MC5    : Balance model
S/N     030800046      : Serial no. of the balance
Id         4-32-1      : ID no. (e.g., for identifying
                          a workstation/operator)
---------------------
Date : 30-Jul-95       : Current date
Start:  10:05:30       : Time at which the application started
Ser. :                 : Field for entering the project number
Lim    +       1.0 %   : Reference data (in this case, "tolerance
                          and target weight"— see also part 3,
Setp   +    42.903 mg    "Application Programs")
pRef   +      100 %
Wxx%   +    42.903 mg
Prc    +      100.6 %  : Value measured (in this case,
                          "calculated percentage")
End  :  10:05:45       : End of application
Name :                 : Field for signature of the operator responsible
---------------------
```

Setting the ID No./Date/Time
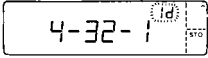
– Turn the balance off

– Turn it back on

– Briefly press ⤴/ when all segments are displayed

– Toggle among the identification number "Id,"
  the date "dAt" and the time "tIN" using the F1/ key
  identified in the display by "∧"

"ID No. for the ISO/GLP-compliant
Printout or Record"
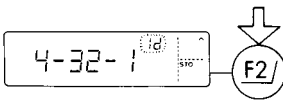
Enter the ID number with 8 places maximum using
digits 0 through 9 and the "–" symbol. Zeros in front
of the decimal point will not be output. The decimal
points are output as "–" via the data interface.

– Enter ID number, e.g., ④⊙③②⊙①

– Press F2/ identified in the display by "STO"
  to confirm the setting

"Date"

10.09.93 `dAt` `STO` → (F2/)
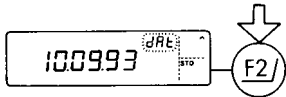
– Separate the day, month and year by pressing the "⊙" key, e.g., ①⓪⊙⓪⑨⊙⑨③

– Press F2/ identified in the display by "STO" to confirm the setting

"Time"

19.05.30 `tim` `STO` → (F2/)
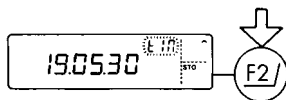
– Separate the hours, minutes and seconds by pressing the "⊙" key, e.g., ①⑨⊙⓪⑤⊙③⓪

– Use F2/ identified by "STO" to set the hours, minutes and seconds entered according to your local time

(F1/)

10.05.45 `24h` `STO`
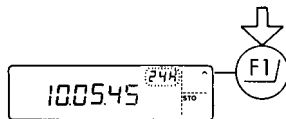
– Press F1/ identified by "^" to select the "12-hr" display mode, and store this setting by pressing F2/ identified by "STO" (in this display mode, an "A" (morning) or a "P" (afternoon) is displayed for the "hours")

or

– Press F2/ identified by "STO" to directly store the "24-hr" display mode

(CF/)

– **End this function** by pressing CF/

Application Programs

In addition to the functions implemented strictly for weighing, Sartorius MC Balances offer you a variety of application programs.

In this description, you'll find a few simple examples for the following applications:
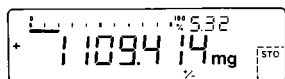
"EUREKA" air buoyancy correction program
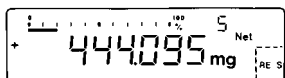
Differential weighing and backweighing program
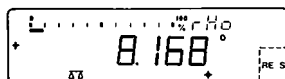
Density [1])
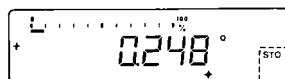
Diameter determination [2])

Tare memory
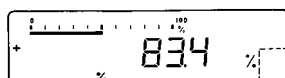
Weighing in percent
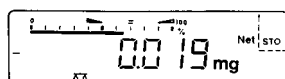
Over/under checkweighing
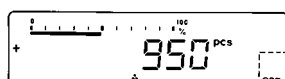
Counting

[1]) only on models MC 210 S (-0CE), MC 210 P (-0CE), MC 410 S (-0CE)
[2]) only on models MC 5 (-0CE) or SC 2 (-0CE), MC 21 S

You can also use these programs in combination. How?
You'll discover the ins and outs in the examples described on the next pages.

To select an application program or a specific function, set the appropriate code in the menu. Part 2 describes in detail how to set menu codes.

Additional settings for running the particular program and displaying or printing the data on hard copy are listed in a table of codes. For your convenience, we've indicated all factory-set codes with an "*."

Important Note for Verified Balances Approved for Use as Legal Measuring Instruments:

Use of Balances Approved for Use as Legal Measuring Instruments in the EU*

All application programs can be selected on balances used as legal measuring instruments. Non-metric values are indicated as follows:
Percent   = **%**
Piece count (counting) = **pcs**
Computed value   = **o**

The display symbol "R2" flashes to identify non-verified weights (not legal for trade).

Functions Common to All Programs

The F1/, F2/ and S/ keys are assigned different functions by the individual programs. The functions assigned to the F1/ and F2/ keys are always identified on the display next to each key.

CF/ Key

CF/ clears the function of a program you are using and resets the program.

Clear function	Code		
Global – clears functions of all keys	2	4	1*
Selective clearing in the order of F1/ → F2/	2	4	2
Selective for F1/ or F2/	2	4	3

Use the **selective** code if you intend to run two different programs at the same time.

Select **code 2 4 2** if you would like to clear the program assigned to the F1/ key before you clear the program assigned to the F2/ key.

If you would like to clear a function in any order, choose **code 2 4 3.** When you press the CF/ key, this clear function is indicated on the application display. Now you can activate it by pressing F1/ or F2/ to clear the particular program function. To clear "CF" indicated on the display, press CF/ again.

* = factory setting

Information and Printouts or Data Transfer

The info key $\underline{i}/$ has two functions:

– one brief press: displays information and prints/transfers stored data;
– one long press: selects the reference percentage or reference sample
                                      quantity for weighing in percent, diameter determination
                                      or counting; clears the memory in the backweighing
                                      mode (for more information, see the descriptions
                                      of these programs)
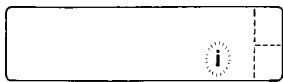
Briefly press the $\underline{i}/$ key to select the information
function: an "$\mathbf{i}$" will appear on the display.

If you press $\underline{F1}/$ or $\underline{F2}/$ now, the data stored
in the memory will be retrieved and displayed. What
is displayed depends on the program selected.
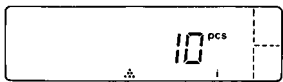
Example: counting
Readout: reference sample quantity (pcs)

`nRef  + xxxxxxxx pcs`
`wRef  + xxxxxxxx g`

Data output only for
code 7 2 2

These data will also be output via the
interface (printed or transferred) if you
press the print key after the info key.
In this case, the print symbol $\otimes$ will be displayed
next to the "$\mathbf{i}$" until you press
a function key.

Info + function key → displays data stored in the memory

Info + print + function key → displays and prints data stored

Data ID Code K* or NUM

Just by pressing a key on the balance, you can have numeric entries with ID codes
transmitted to an on-line device via the interface.

Function: Keys:
Output data ID code "K*"   numeric entry + $\underline{i}/$
Output data ID code "NUM"   numeric entry + $\underline{o}/$

"EUREKA" Air Buoyancy Correction Program

"EUREKA" Air Buoyancy Correction Program   Code 2 1 8

Symbol displayed: **+/−**

Key identified by:
– STO - F2/ when the air density is 1.2 kg/m^3
– STO ● - F2/ when the air density is different from 1.2 kg/m^3 *

Because of air buoyancy, samples or objects with the same mass but different densities have different weights.
To obtain the true mass of the sample, the weight is multiplied by the following factor:

$$K = \frac{1 - \dfrac{\varrho_L}{\varrho_{ST}}}{1 - \dfrac{\varrho_L}{\varrho_W}}$$

where:
ϱ_L = air density in kg/m^3
ϱ_{ST} = density of steel 8000 kg/m^3 (calibration weight)
ϱ_W = density of the object/sample to be weighed in kg/m^3

Important Note for Verified Balances Approved for Use as Legal Measuring Instruments in the EU:*

You may not use weights corrected for the effects of air buoyancy when the balance is being used as a legal measuring instrument. The display symbol "R2" flashes to identify non-verified weights (not legal for trade).

* = for directions on air density determination, see page 3−9
** = including the Signatories of the Agreement on the European Economic Area

The following diagram shows the required corrections of mass values Δm for a few selected density values ϱ_W. The incorrect values result from the effects of air buoyancy. The corrections depend on the weights displayed on the balance.

Correction of the mass Δm (milligrams)

Add the mass error to the weight displayed on the balance

Subtract the mass error from the weight displayed on the balance

$\varrho_w = 0.8\ \dfrac{g}{cm^3}$

$\varrho_w = 1.0\ \dfrac{g}{cm^3}$

$\varrho_w = 1.4\ \dfrac{g}{cm^3}$

$\varrho_w = 2.0\ \dfrac{g}{cm^3}$

$\varrho_w = 4.0\ \dfrac{g}{cm^3}$

$\varrho_w = 8.0\ \dfrac{g}{cm^3}$

$\varrho_w = 22.5\ \dfrac{g}{cm^3}$

Density of the object to be weighed

Weight displayed on the balance (grams)

$\varrho_w = 0.0012\ \dfrac{g}{cm^3}\ (air)$
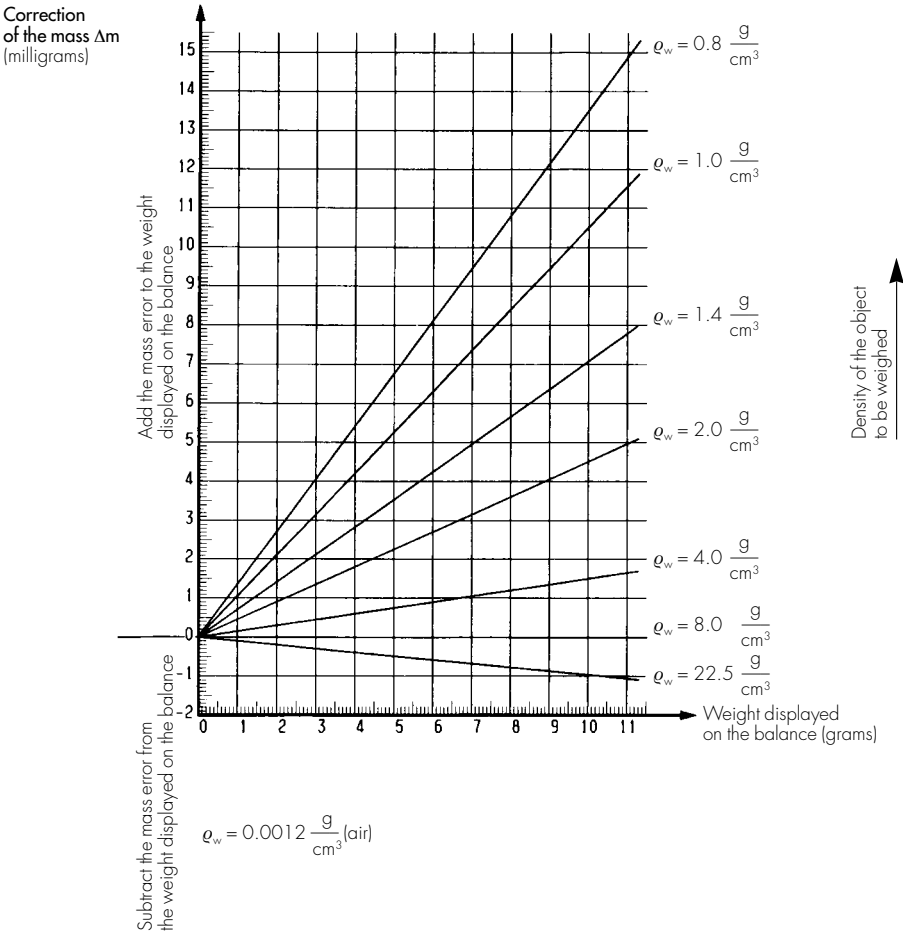
Example: aluminum: conventional mass of 2 g (density 2.7)

	Readout
Without air buoyancy correction→ +	2000.000 mg
With air buoyancy correction→ +	2000.**589** mg

3–6

Changing the Density of a Sample

Enter the density of a sample using the numeric keys and then confirm this value by pressing the F2/ key identified by "STO." Afterwards, the density that you entered will be shown in the application display. This density is used to calculate the absolute mass of the sample on the balance.

The density must be entered in grams per cubic centimeter (g/cm^3). A density may not be greater than 22.5 g/cm^3 or less than 0.1 g/cm^3. The density that you enter will be stored in the non-volatile memory.

Recalling a Stored Density

You can recall the density that you last used by pressing the F2/ key identified in the display by "STO."
Press the ⮌/ key at any time to toggle between weight and mass.

Air Buoyancy Correction after an Air Density Determination

A special function makes it possible to determine and store the air density (for more information see p. 3–9). The density can be between 1.0 kg/m^3 and 1.4 kg/m^3. If the air density determined deviates from the standard value of 1.2 kg/m^3, the F2/ key normally identified by STO is shown as STO ●.

Use in Combination with Other Programs

The air buoyancy correction program can be used in combination with other application programs. This means you will have all functions of the combined program available in addition.

Program	Code		
Over/under checkweighing (net weight)	2	2	3
Over/under checkweighing (difference in weight)	2	2	4

Practical Example: Air Buoyancy Correction in the Manufacture of an Alloy

Menu codes used in the example:

Function	Code
Air buoyancy correction	2 1 8
Automatic output of the air density and density of the sample	7 1 2
With data ID code	7 2 2

As an alternative, you can select this code:

Data output – manual mode	7 1 1*

Application: Manufacture of alloys according to stoichiometric proportions; for example, superconductor "Nb_3Ge" (molecular weight: niobium 41, germanium 64)

Step/Key ID/Key	Readout		Data Output		
Place container on pan	+	122.650 mg			
Zero the balance using TARE/		0.000 mg			
Enter density for first sample (germanium): ⑤⊙③② and confirm: STO-F2/		5.32	RhoL +	1.200	kg/
			RhoG +	5.32	g /
Add germanium and press ⊙/	+	500.000 mg	m +	500.000	mg
TARE/		0.000 mg			
Enter density for 2nd sample (niobium): ⑧⊙④ and confirm using STO-F2/		8.4	RhoL +	1.200	kg/
			RhoG +	8.4	g /
Add niobium and press ⊙/	+	1921.875 mg	m	+ 1921.875	mg

The data ID codes			mean:
RhoL	+	1.200 kg/	air density
RhoG	+	8.4 g /	density of the sample
m	+	1921.875 mg	weight which has been corrected for air buoyancy

* = factory setting

3–8

Air Density Determination

For highly precise analyses, the balance offers you a function with which fluctuations in the air density can be determined.

⚠ The air density at the place you set up your balance can be determined **within the range of 1.0 kg/m^3 and 1.4 kg/m^3.**

For determining the air density, use the special weight set which is available as an accessory (see also part 5, "Accessories"). This weight set consists of one steel and one aluminum weight. Their exact mass values are specified on a certificate, which is included with the set. By a differential weighing method, the air density is determined using the two weights.

To access this function, set the appropriate code in the balance operating menu:

Air density determination	Code
Accessible	1 16 1
Access denied	1 16 2*

Use the CF/ key at any time to stop air density determination.

* = factory setting

The air density is calculated according to the following formulas:

Formula 1:

$\varrho_L = \dfrac{m_a * W_S - m_S * W_a}{\dfrac{m_a * W_S}{\varrho_a} - \dfrac{m_S * W_a}{\varrho_s}}$

ϱ_L = Air density in kg/m^3

ϱ_S = Density of steel in kg/m^3

m_S = Mass of steel

W_S = Measured value of steel

ϱ_A = Density of aluminum in kg/m^3

m_A = Mass of aluminum

W_A = Measured value of aluminum

Formula 2:

$m_S = M_S * \dfrac{1 - \dfrac{1.2}{8000}}{1 - \dfrac{1.2}{\varrho_S}}$

ϱ_S = Density of steel in kg/m^3

M_S = Conventional mass of steel

m_S = Mass of steel

Formula 3:

$m_A = M_A * \dfrac{1 - \dfrac{1.2}{8000}}{1 - \dfrac{1.2}{\varrho_A}}$

ϱ_A = Density of aluminum in kg/m^3

M_A = Conventional mass of aluminum

m_A = Mass of aluminum
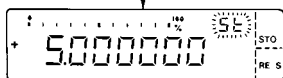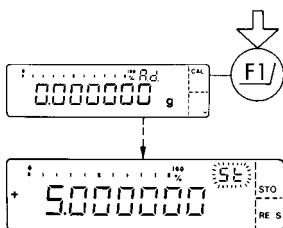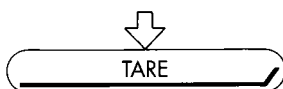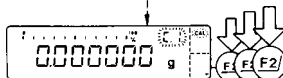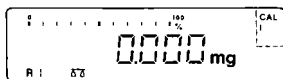
Activating the Air Density Determination Function

Hold down the tare key for more than 2 seconds until "**C.I.**" and "**CAL**" are displayed next to the F1/ key.

To activate the **air density determination** function, press F2/, identified by "v," several times until "**A.d.**" is displayed.

"**A.d.**" stands for "**air density.**"

Unload the weighing pan and tare the balance.

Starting Air Density Determination

To start air density determination, press the F1/ key when the display shows a zero readout. Afterwards, a weight for steel "St" is displayed.

"Err 02":   The effects of an external disturbance can cause the error code "**Err 02**" to be displayed briefly. If this occurs, tare the balance and then press the F1/ key again when the display shows a zero readout.

Interrupt
procedure: You can stop an air density determination procedure at any time:
– By pressing the CF/ key so that a previously stored air density is not changed or
– By pressing F2/ identified in the display by "RES" to set the standard air density 1.2 kg/m^3

3–11

Using the Weight Set for Air Density Determination
– Steel Weight –
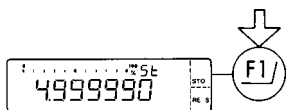
Use the numeric keys to enter the exact mass value specified for the certified steel weight (e.g. ④⊙⑨⑨⑨⑨⑨⓪) and store this value by pressing the F1/ key identified in the display by "STO."

If you press F1/, identified by "STO," without making a numeric entry, the display changes to the density readout. Now you can change it for a special steel weight. Enter the mass value and press F1/ to define this density.

Center the steel weight on the weighing pan and close the draft shield.
After the steel weight has been confirmed, the display will show a zero readout. Now, remove the steel weight from the weighing pan and close the draft shield. Afterwards, if the value for the aluminum weight "Al" is displayed, you can continue with the procedure.

"Err 03": The effects of an external disturbance can cause the error code "Err 03" to be displayed briefly. If this occurs, restart the air density determination procedure.

– Aluminium Weight –
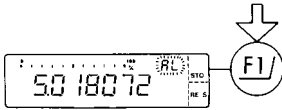
Use the numeric keys to enter the exact mass value specified for the certified aluminum weight (e.g., ⑤⊙⓪①⑧⓪⑦②), and store this value by pressing the F1/ key identified in the display by "STO."
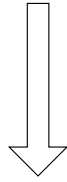
If you press F1/, identified by "STO," without making a numeric entry, the display changes to the density readout. Now you can change it for a special aluminum weight. Enter the mass value and press F1/ to define this density.
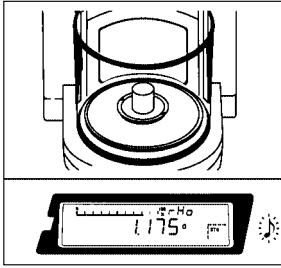
Center the aluminum weight on the weighing pan and close the draft shield.

After the aluminum weight has been confirmed, the calculated air density between 1.1 kg/m^3 and 1.3 kg/m^3 will be displayed.

If the air density determination result is a value which is not between 1.0 kg/m^3 and 1.4 kg/m^3, the determination procedure is interrupted with two beeps and the previous air density remains stored. If this occurs, restart the air density determination procedure after the two beeps.

Storing the Air Density and Ending the Procedure

– Store the air density displayed by pressing the F2/ key identified by "STO" or
– Reset the display to the standard value 1.2 kg/m^3 with the CF/ key and store this value by pressing the F2/ key identified by "STO"

An acoustic signal indicates the end of the air density determination procedure.

3–13

Differential Weighing and Backweighing

Differential Weighing and Backweighing   Code 2 1 6

Symbol displayed: % **S**

The purpose of this application is to weigh a certain sample in original condition and then after treatment, such as drying, to determine the difference between the two weights and the remaining sample quantity. This is done either in percent or in a weight unit.

For each sample, the net weights are compared with each other, since the tare weights are stored first and later subtracted. Tare weighing can be de-activated, if a container will not be used in the treatment process. There are memory locations for a maximum of 50 samples.
Backweighing, which means weighing a sample after a chemical or thermal reaction, can be done in any sequence (known as "random" backweighing). It is also possible to perform several backweighing operations. In this case, each backweighing operation is done in reference to the original sample weight (= 100%).

Therefore, the usual sequence of the weighing operations is as follows: tare weighing - weighing-in - backweighing. This sequence can be performed according to the individual or combined weighing mode.

⚠ Charging the Battery for Data Storage

It goes without saying that the data are stored in a battery-backed memory. When the balance is unplugged from AC power, the data generated will remain stored for approximately three months. In the standby mode, the data are retained by the internal power supply. The rechargeable battery can also become discharged after relatively long periods of storage. In this case, or for initial startup, leave the balance connected to AC power for about 12 hours to charge the battery.

Weighing Sequence

Individual or Combined Weighing Mode

Individual Weighing Mode
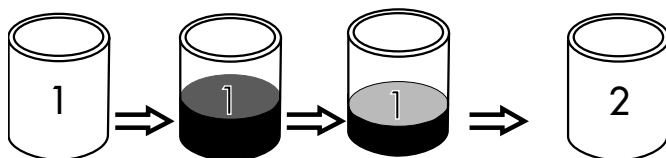
In the **individual weighing mode,** the weights are stored in the following sequence:

– Tare weighing – weighing-in – backweighing
– If necessary, selection of an available memory location
– Tare weighing – weighing-in – backweighing…

The data of a sample in a memory location are overwritten until a new memory location is selected.

In the **consecutive individual weighing mode,** the weights are stored in this sequence:
– Tare weighing – weighing-in – backweighing
– Automatic selection of the next memory location
– Tare weighing – weighing-in – backweighing…

Beginning at a specific memory location, the memory locations that follow are selected automatically using the F2/ key. It is also possible to switch to a new memory location using the numeric keys and the F2/ key.

Combined Weighing Mode
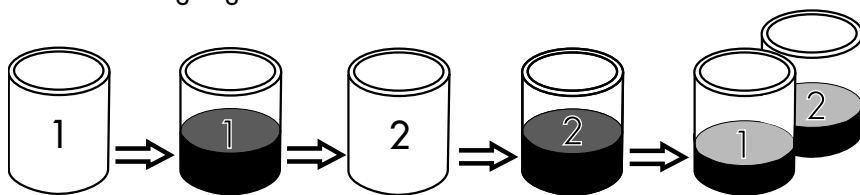
In the **combined weighing mode,** the values are stored in the following sequence:
– Tare weighing – weighing-in – tare weighing – weighing-in…
Backweighing is done only after all of these operations have been completed.

After each weighing-in operation has been completed, the next memory location is automatically selected. To proceed from weighing-in to backweighing, you must select the corresponding memory location ID by entering the appropriate number and pressing the F2/ key.

Configure your weighing sequence according to your particular requirements:

Weighing sequence	Code					
	For MC 210 S, MC 210 P, MC 410 S (-0CE)			For MC 5 (-0CE), SC 2 (-0CE) and MC 21 S		
Individual weighing	3	7	1	3	6	1
Consecutive individual weighing	3	7	2*	3	6	2*
Combined weighing	3	7	3	3	6	3

* = factory setting
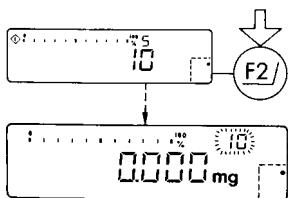
Selecting the Memories

Use the numeric keys to enter any memory location ID number up to "50." Press the F2/ key to have your entry accepted and shown in the application display (in the upper, right-hand corner). At the same time, the weight readout will reappear.

Number of Sample Data Stored in a Memory Location

One memory location can store the following data for a sample:
– Tare value identified by *t̄Ar*
– Net initial sample weight identified by *nEt*
– Net sample residue (backweighed qty.) identified by *rE5*
– Date on which the last value(s) were stored *dAt* (Tar, Net, Res)
– Time when the last value(s) were stored *tIn* (Tar, Net, Res)

Each time the balance is turned on, the memory location ID that was active before the unit was turned off is selected. The program automatically resumes at the place where you left off.

Key Functions

Function:	Key(s):
Select memory location ID	Numeric entry + F2/
Store tare value	● - F2/
Store initial sample weight	STO - F2/
Store residue (backweighed sample)	RE S - F2/
Toggle between backweighing/standard weighing modes in the individual weighing mode	ꓛ/
Toggling after backweighing between two calculated values and the "weighing mode"	ꓛ/
Proceed from weighing-in to back-weighing in the combined weighing mode	Numeric entry (memory location ID no.) + F2/
Output of all values up to current operation	◎/
Cancel previous operation	CF/
Delete stored data from the memory location displayed	Press CF/ >2 sec.
Delete entire memory	Press i/ >2 sec. and then press STO - F2/

Procedures for the Individual Weighing Mode

Tare Weighing

Symbol displayed: **Net**
Key identified by: ● - F2/

Press the F2/ key identified on the display by "●" to accept and store a weight as the tare value. The tare weight will be stored only if the balance has stabilized. At this point, the balance display is zeroed. After tare weighing, the net weight of a sample is determined. The ID code of F2/ in the display changes from "●" to "STO." Afterwards, weighing can be done starting from "zero."

The tare weighing mode can be turned off by setting the appropriate menu code:

Weighing sequence	Code					
	For MC 210 S, MC 210 P, MC 410 S (-0CE)			For MC 5 (-0CE), SC 2 (-0CE) and MC 21 S		
Off	3	8	1*	3	7	1
On	3	8	2	3	7	2*

Weighing-in

Key identified by: STO - F2/

The stable net weight displayed is stored when you press F2/ identified on the display by "STO."

Backweighing

Key identified by: RE S - F2/

Key identification when a value is stored: RE S v - F2/

The stable backweighed sample, the residue, is stored when you press F2/ identified on the display by "RE S."

By setting the appropriate codes in the balance operating menu, you can select the display modes for two calculated values. Use the ⊆/ key to toggle between these two values. The first difference calculated between the net initial sample weight and the residue is automatically displayed. In the display modes "residue in the specified weight unit" and "residue in percent," the "Net" symbol indicates that the tare value was subtracted.
At the same time, the identification code shown on the display for the F2/ key changes to "RES v" to indicate that a value has been stored in the particular memory.

* = factory setting

The calculated value is locked into the display once the sample residue has been stored. To "unlock" this readout, press RE S v - $\underline{F2}$/ or select a different memory location using the numeric keys and $\underline{F2}$/. Afterwards, you can proceed with the next tare weighing.

A stored value of a backweighed sample can be overwritten with a current value anytime after the corresponding memory location has been selected. To do this, press $\underline{CF}$/. A backweighing operation is done in reference to the original sample weight (= 100%).

Once you have completed processing or treatment of a series of samples, you can select another memory location using the numeric keys. Therefore, you can perform backweighing in any sequence (known as "random backweighing"). In the consecutive individual weighing mode, the next memory location is automatically selected using the RE S v - $\underline{F2}$/ key after backweighing (code 3 6 2).

Important Note for Verified Balances Approved for Use as Legal Measuring Instruments in the EU:*

You may not use the calculated value when the balance is being used as a legal measuring instrument. The display symbol "R2" flashes to identify non-verified weights (not legal for trade).

* including the Signatories of the Agreement on the European Economic Area

Practical Example: Residue Determination of Samples in Containers

Menu code settings used in the example:

Function	Code For MC 210 S, MC 210 P, MC 410 S (-0CE)	For MC 5 (-0CE), SC 2 (-0CE) and MC 21 S
Differential weighing and backweighing	2 1 6	2 1 6
Consec. indiv. weighing	3 7 2*	3 6 2*
Automatic data output	7 1 2	7 1 2
With data ID code	7 2 2	7 2 2
2 decimal places for the results in percent	3 6 3*	3 5 3
With tare weighing	3 8 2	3 7 2*
1st calculated value: residue in wt. unit	3 9 1*	3 8 1*
2nd calculated value: residue in percent	310 2	3 9 2
Record/printout with net initial sample weight	7 5 3*	7 5 3*
Record/printout with residue in wt. unit and percent	7 6 4	7 6 4

As alternatives, you can select these codes:

Different number of decimals	3 6 x	3 5 x
Without tare weighing	3 8 1	3 7 1
Different calculated value	3 9 x	3 8 x
Different calculated value	3 10 x	3 9 x
Other record printout/output	7 5 x	7 5 x
Other record printout/output	7 6 x	7 6 x

Application: Brief sample treatment, such as ashing (incineration). A value is recorded/printed out automatically after backweighing.

Step/Key ID/Key	Readout	Data Output
Enter memory location/ container ID; e.g., ⑦, and press F2/ to confirm	7	
Zero the balance using TARE/	0.000 mg	
Place container on pan; store weight using ● - F2/	+ 376.307 mg 0.000 mg Net	
Add prepared sample to container; store weight using STO - F2/	+1095.335 mg Net +1435.642 mg	
Treat sample (e.g., incinerate)		
Place container with treated sample on pan Backweigh using RE S - F2/	+ 991.571 mg + 615.264 mg Net	Num 7 Date 19-Jul-95 Time 10:34:54 Net + 1059.355 mg Res + 615.264 mg Res + 58.08 %
Toggle to readout of 2nd calculated value: S/	+ 58.08 % Net	
Repeat procedure for the next memory location: RE S v - F2/, or to delete data stored in the memory location for this sample, press CF/ > 2 sec.	8	

The data ID codes	mean:
Num 7	memory location ID number
Date 9-Jul-95	date of backweighing
Time 10:34:54	time of backweighing
Net + 1059.355 mg	net initial sample weight
Res + 615.264 mg	net residue (backweighed sample) in wt. unit
Res + 58.08 %	residue in percent

* = factory setting

Procedures for the Combined Weighing Mode

Tare Weighing

Symbol displayed: **Net**
Key identified by: ● - F2/

Press F2/ identified by "●" to accept and store a weight as the tare value. The tare weight will be stored only if the balance has stabilized. At this point, the balance display is zeroed. After tare weighing, the net weight of a sample is determined. The ID code of F2/ in the display changes from "●" to "STO." Afterwards, weighing can be done starting from "zero."

The tare weighing mode can be turned off by setting the appropriate menu code:

Tare weighing	Code					
	For MC 210 S, MC 210 P, MC 410 S (-0CE)			For MC 5 (-0CE), SC 2 (-0CE) and MC 21 S		
Off	3	8	1*	3	7	1
On	3	8	2	3	7	2*

Weighing-in

Key identified by: STO - F2/

The stable net weight is stored when you press the F2/ key identified on the display by "STO." When the weight is stored, the next memory location ID is automatically selected.

Before you can proceed from weighing-in to backweighing, the appropriate memory location ID number must be selected using the numeric keys and F2/.

* = factory setting

Backweighing

Key identified by: RE S - F2/
Key identification when a value is stored: RE S $_v$ - F2/

The stable backweighed sample, the residue, is stored when you press F2/ identified in the display by "RE S."
By setting the appropriate codes in the balance operating menu, you can select the display modes for two calculated values. Use the S/ key to toggle between these two values. The first difference calculated between the net initial sample weight and the residue is automatically displayed (factory setting "residue in milligrams," code 3 8 1). In the display modes "residue in milligrams" and "residue in percent," the "Net" symbol indicates that the tare value was subtracted. At the same time, the identification code shown on the display for the F2/ key changes to "RE S v" to indicate that a value has been stored in the particular memory.

The calculated value is locked into the display once the sample residue has been stored. To "unlock" this readout, press RE S v - F2/ or select a different memory location using the numeric keys and F2/.

The next memory location is automatically selected with the RE S v - F2/ key after backweighing. In addition, you can select further memory locations in any sequence using the numeric keys (known as "random backweighing").

To backweigh a sample, weighing-in must be completed first. A stored value of a backweighed sample can be overwritten with a current value anytime after the corresponding memory location has been selected. To do this, press CF/.
A backweighing operation is done in reference to the original sample weight (= 100%).

> **Important Note for Verified Balances Approved for Use as Legal Measuring Instruments:**
>
> You may not use the calculated value when the balance is being used as a legal measuring instrument. The display symbol "R2" flashes to identify non-verified weights (not legal for trade).

Practical Example: Dry Weight Determination with Tare Weighing

Menu code settings used in the example:

Function	Code For MC 210 S, MC 210 P, MC 410 S (-OCE)	For MC 5 (-OCE), SC 2 (-OCE) and MC 21 S			
Differential weighing and backweighing	2 1 6	2 1 6			
Combined weighing mode	3 7 3*	3 6 3*			
Automatic data output	7 1 2	7 1 2			
With data ID code	7 2 2	7 2 2			
2 decimal places for the results in percent	3 6 3*	3 5 3			
With tare weighing	3 8 2	3 7 2*	As alternatives, you can select these codes:		
1st calculated value: residue in percent	3 9 2	3 8 2	Different number of decimals	3 6 x	3 5 x
2nd calculated value: residue in wt. unit	3 10 1	3 9 1	Without tare weighing	3 8 1	3 7 1*
			Different calculated value	3 9 x	3 8 x
Record/printout with net initial sample weight	7 5 3*	7 5 3*	Different calculated value	3 10 x	3 9 x
Record/printout with residue in wt. unit			Other record printout/output	7 5 x	7 5 x
and percent	7 6 4	7 6 4	Other record printout/output	7 6 x	7 6 x

Application: Determination of the dry weight (solids) in percent of samples over a relatively long period, e.g., using a drying oven. The containers for the samples are consecutively numbered and placed in the correct sequence. In this particular application, let's suppose that your in-house standard operating procedure does not allow backweighing to be done immediately after weighing-in a sample.

* = factory setting

Step/Key ID/Key	Readout	Data Output
Enter memory location/contianer ID, e.g., ①⓪ and store using F2/	10	
Zero the balance using TARE/	0.000 mg	
Place container on pan; store weight using ● − F2/	+ 355.916 mg 0.000 mg Net	
Add sample to container; store weight using STO − F2/	+ 780.352 mg Net +1136.268 mg 11	
Remove container with sample	0.000 mg	
Load next container; store weight using ● - F2/	+ 375.235 mg 0.000 mg Net	
Add sample to container store weight using STO - F2/	+ 889.715 mg Net +1264.950 mg	
Store weights of other containers and weigh-in further samples	12	
Treat samples (e.g., dry samples)		
Enter 1 st memory location/ container ID ①⓪ and press to confirm ● - F2/	10	
Zero the balance using TARE/	0.000 mg	
Place corresponding container on pan; backweigh using RE S - F2/	+ 934.696 mg + 74.17 % Net	Num 10 Date 9-Jul-95 Time 10:34:54 Net + 780.352 mg Res + 578.780 mg Res + 74.17 %
If necessary, press S/ to display 2nd calculated value	+ 578.780 mg Net	
Repeat procedure for all samples RE S V - F2/	11	

The data ID codes			mean:
Num		10	memory location ID number
Date	9-Jul-95		date of backweighing
Time	10:34:54		time of backweighing
Net	+	780.352 mg	net initial sample weight
Res	+	578.780 mg	net residue (backweighed sample) in weight unit
Res	+	74.17 %	residue in percent

Practical Example: Measuring the Coating Mass without Tare Weighing

Menu code settings used in the example:

Function	Code For MC 210 S, MC 210 P, MC 410 S (-OCE)	For MC 5 (-OCE), SC 2 (-OCE) and MC 21 S
Differential weighing and backweighing	2 1 6	2 1 6
Combined weighing mode	3 7 3	3 6 3
Without tara weighing	3 8 1*	3 7 1
Automatic data output	7 1 2	7 1 2
With data ID code	7 2 2	7 2 2
2 decimal places for the results in percent	3 6 3*	3 5 3
1st calculated value: residue in wt. unit	3 9 3	3 8 3
Record/printout with net initial sample weight	7 5 3*	7 5 3*
Record/printout with residue in wt. unit	7 6 2*	7 6 2*
Record/printout with difference in wt. unit	7 7 2	7 7 2

As alternatives, you can select these codes:

Different number of decimals	3 6 x	3 5 x
Different calculated value	3 9 x	3 8 x
Other record/ output	7 5 x	7 5 x
Other record/ output	7 6 x	7 6 x
Other record/ output	7 7 x	7 7 x

Application: Determination of the mass (weight) of coatings on substrates or support materials (e.g., electronic parts or filter weighing). In this particular application, let's suppose that your in-house standard operating procedure does not allow backweighing to be done immediately after weighing-in a sample.

* = factory setting

Step/Key ID/Key	Readout	Data Output
Enter memory location ID no., e. g., ①⓪ and store using ● - F2/	I0	
Zero the balance using TARE/	0.000 mg	
Place substrate on pan and store using STO - F2/	+1221.284 mg +1221.284 mg II	
Remove substrate	0.000 mg	
Place next substrate on pan and store using STO - F2/	+1232.265 mg +1232.265 mg	
Remove substrate and weigh-in further samples	I2	
Coat material		
If necessary for a longer process, use the �/ key to turn the program off and back on again		
Enter 1 st memory location ID ①⓪ and store using ● - F2/	I0	
Zero the balance using TARE/	0.000 mg	

Place coated material on pan; backweigh using RE S - F2/	+1349.793 mg
	+ 128.509 mg
		`Num          10`
		`Date    9-Jul-95`
		`Time    10:44:54`

Remove material and backweigh further samples using RE S v - F2/	II	`Net  + 1221.284 mg`
		`Res  + 1349.793 mg`
		`Diff +  128.509 mg`

The data ID codes	mean:
`Num          10`	memory location ID number
`Date    9-Jul-95`	date of backweighing
`Time    10:44:54`	time of backweighing
`Net  + 1221.284 mg`	net initial sample weight
`Res  + 1349.793 mg`	net residue (backweighed sample) in wt. unit
`Diff +  128.509 mg`	difference in weight unit

Toggling between Two Calculated Values after Backweighing and "Standard Weighing"

After backweighing, you can press the ⊥/ key to toggle between two calculated values and the "standard weighing mode." Once you have set the desired menu codes, the following calculated values can be displayed:

Readout of the 1st Calculated Value

Calcuated value	Code					
	For MC 210 S, MC 210 P, MC 410 S (-0CE)			For MC 5 (-0CE), SC 2 (-0CE) and MC 21 S		
Residue in selected wt. unit	3	9	1*	3	8	1*
Residue in percent	3	9	2	3	8	2
Difference in selected wt. unit	3	9	3	3	8	3
Difference in percent	3	9	4	3	8	4

Readout of the 2nd Calculated Value

Calcuated value	Code					
	For MC 210 S, MC 210 P, MC 410 S (-0CE)			For MC 5 (-0CE), SC 2 (-0CE) and MC 21 S		
Residue in selected wt. unit	3	10	1	3	9	1
Residue in percent	3	10	2	3	9	2
Difference in selected wt. unit	3	10	3	3	9	3*
Difference in percent	3	10	4*	3	9	4

Calculation is done according to these formulas:

$$\text{Residue in percent} = \frac{\text{Residue (backweighed sample)}}{\text{Net initial sample weight}} \cdot 100\%$$

$$\text{Difference in percent} = \frac{\text{Residue} - \text{initial sample weight}}{\text{Initial sample weight}} \cdot 100\%$$

* = factory setting

De-activating the Differential Weighing and Backweighing Program during a Weighing Procedure ("Standard Weighing Mode")

To turn off the differential weighing and backweighing program function, press ⇒/.
The function keys will now be blocked and the identification symbols will no longer
be displayed.
Blocking the function keys ensures that the values you have stored will not be erased
by another operator or calculated based on an incorrectly entered backweighed
sample quantity, especially if you do not perform the differential weighing steps
immediately in succession. This allows you to weigh in the standard mode and
print weights in the meantime without affecting your other results.

Important Note:

If you turn off the differential weighing and backweighing program after tare
weighing, you will have to store the respective tare value again.

Clearing the Memory

How to delete data stored in individual memory locations:

– Select the respective memory location using the numeric keys and F2/
– Hold down the CF/ key for more than 2 seconds

How to delete the entire memory contents:

– Hold down the i/ key for more than 2 seconds
– When "CLEArALL" is displayed, press STO - F2/

The entire memory contents will now be cleared and the clear function terminated.
If you do not wish to clear the entire memory, you can interrupt this procedure
by pressing CF/ when "CLEArALL" is displayed.

⚠ **Caution!**

If you press F2/ when "CLEArALL" is displayed, all data stored
in the memory will be deleted.

Record Configuration

Depending on the particular menu code setting selected, data are released or blocked for a printout or on-screen output. Configure the data output record according to your specific requirements as follows:

Record with Date/Time:

Output "Date/Time"	Code		
Off	7	4	1
Date only	7	4	2
Time only	7	4	3
Date and time	7	4	4*

Record with Tare Weight/Net Initial Sample Weight

Output "Tar/Net":	Code		
Off	7	5	1
Tare weight only	7	5	2
Net initial sample weight only	7	5	3*
Tare weight and net initial sample weight	7	5	4

Record with Residue:

Output "Res"	Code		
Off	7	6	1
Residue in wt. unit only	7	6	2*
Residue in percent only	7	6	3
Residue in wt. unit and percent	7	6	4

Record with Difference:

Output "Diff"	Code		
Off	7	7	1*
Difference in wt. unit only	7	7	2
Difference in percent only	7	7	3
Difference in wt. unit and percent	7	7	4

* = factory setting

Differential Weighing and Backweighing with Additional Requirements

Display Parameter for Readouts in Percent

One of the following display parameters can be set for readouts in percent:

The readout in percent is displayed	Code					
	For MC 210 S, MC 210 P, MC 410 S (-0CE)			For MC 5 (-0CE), SC 2 (-0CE) and MC 21 S		
Without decimal places	3	6	1	3	5	1
With one decimal place	3	6	2	3	5	2*
With two decimal places	3	6	3*	3	5	3
With three decimal places	3	6	4	3	5	4

Use in Combination with Other Programs

The differential weighing and backweighing program can be used in combination with other application programs. This means you will have all functions of the combined program available in addition.

Program	Code		
Over/under checkweighing (net weight)	2	2	3
Over/under checkweighing (difference in weight)	2	2	4

* = factory setting

Density [1])

Density   **Code 2 1 7**

Symbol displayed: ♦

Key identified by: STO - F2/

You can determine the density of solid, liquid and powdery samples according to one of two methods:
– Buoyancy method
– Specific gravity bottle method

The Achimedean principle is applied to determine the volume of a particular sample; this volume is necessary for calculating the density.

Methods

Buoyancy Method   To measure the density inside the weighing chamber (toploading configuration), use the YDK 01 (-OD).

Specific Gravity
Bottle Method   The method using a specific gravity bottle is suitable for determining the density (specific gravity) of pasty and powdery samples.

Select the method of your choice by setting the corresponding menu code from the list below.

Density determination method	Code		
Buoyancy	2	6	1*
Specific gravity bottle	2	6	2

> **Important Note Concerning Balances Used as Legal Measuring Instruments in the EU****
>
> The displayed result of the density determination procedure is not a verified value. The display symbol "R2" flashes to identify non-verified values (not legal for trade).

[1]) = not for MC 5 (-OCE), SC 2 (-OCE) and MC 21 S microbalances
*   = factory setting
** = including for Signatories of the Agreement in the European Economic Area

Use in Combination with Other Programs

You can use a density program in combination with other application programs assigned to the F1/ key. This means you will have all functions of the combined programs available in addition.

It is especially convenient to combine the density program with the application program listed below:

Application program	Code		
Tare memory	2	2	2

Liquid for Buoyancy/Reference Liquid

You can enter the temperature so that the balance can allow for the effect of this temperature on the liquid of immersion (reference liquid for the specific gravity bottle method) when calculating the density of your sample.

Access the parameter mode to choose the liquid for sample immersion/reference liquid and to allow for the various parameters.

To access the parameter mode: Hold down the i/ key for more than 2 seconds
To select a parameter: Press ^ – F1/
To enter a value: Use the numeric keys
To confirm an entry: Press STO – F2/
To store an entry: Press STO – F2/

The following values are stored in the non-volatile memory:

– Temperature
– Density of the liquid
– Volume expansion coefficient
– Function for calculation of the density of the liquid

You have the following input options:

1) You can directly enter the density of a liquid. In this case, you will not
   be prompted to enter a temperature (1st function). Enter density using the
   numeric keys; press F2/ to store.
2) You can enter the density of a liquid at 20°C and the volume expansion
   coefficient. During density determination, you will then be prompted to enter
   the temperature (2nd function) (see example below).

Practical Example: Entering the Density and the Expansion Coefficient

Procedure/conditions: Ethylene glycol at 23°C will be used as the liquid into
which the samples will be immersed. Its density at 20°C
is 1.113 g/cm^3; its volume expansion coefficient at 20°C
is 0.00064 K^{-1}.

Step/Key	Readout	
Access parameter mode:		
Press i/ > 2 seconds	+	x.xxxxxx g
Enter density		⌐FL
at 20°C: ①⊙①①③ STO – F2/	+	1.113°
Press ^ - F1/ to select "−**b**−"	+	-b-
in the application display	0.00°	
Enter coefficient:		-b-
⓪⊙⓪⓪⓪⑥④ STO – F2/	0.000640°	
Exit parameter mode:		
STO – F2/	x.xxxxxx g	

Formulas Used to Determine the Density

Method

Buoyancy:

$$Rho \quad = \frac{Wa \cdot (Rhofl - LA)}{(Wa - Wfl) \cdot Corr} + LA$$

where:

Rhofl	=	density of the liquid causing buoyancy
Wa	=	weight of the sample in air
Wfl	=	weight of the sample in liquid
Corr	=	correction for buoyancy produced by the immersed wire = 0.99983
LA	=	density of air = 0.0012 g/cm^3

Specific gravity bottle:

$$Rho \quad = \frac{Wa \cdot (Rhofl - LA)}{Wfl + Wa - Wr} + LA$$

where:

Rhofl	=	density of the reference liquid
Wa	=	weight of the sample
Wfl	=	weight of the reference liquid
Wr	=	weight of the sample + reference liquid
LA	=	density of air = 0.0012 g/cm^3

Practical Example: **Buoyancy Method**

Liquid: Water
Temperature: 20°C
Balance used: MC 210 P

Menu code settings used in the example:

Function	Code	
Density	2 1 7	As an alternative, you can select
Method: buoyancy	2 6 1*	this code:
Automatic output		
of all calculated values	7 1 2	Automatic output
With data ID code	7 2 2	of the density 7 1 3

Auxiliary equipment: Sartorius YDK 01 Density Determination Kit
                      Sartorius YDP 03-0CE Data Printer

Application: Determination of the density of samples of a solid

Procedure: Distilled water with a temperature of 20°C will be used
                       as the liquid into which the samples will be immersed.
                       The hard copy is to be identified by the sample ID number
                       "NUM xxx."

* = factory setting

Step/Key ID/Key	Readout	Data Output/Printout
To start program, press <u>CF</u>/ to clear functions	+ xxxxx g	
Enter sample ID number 3.0590: ③⊙⓪⑤⑨⓪ <u>º</u>/	+ 3.0590	**NUM** **3.0590**
Tare with the sample holder immersed: <u>TARE</u>/	+ xx.xxxx g 0.00000 g	
Access program: STO - <u>F2</u>/	ºC + 20.0°	
Confirm temperature of 20°C: STO - <u>F2</u>/	-A- + 0.00000 g	
Place sample on upper metal pan and store weight: STO - <u>F2</u>/	-A- + 15.03908 g	
Immerse sample in sample holder in the water and store weight: STO - <u>F2</u>/	-L- + 13.20269 g	
Read off the calculated density	rHo 8.168°	

```
                                    Temp   +       20.0  'C
                                    Rhofl  +      0.998  g /
                                    Wa     + 15.03908  g
                                    Wfl    + 13.20269  g
                                    Vol    +      1.841  ccm
                                    Rho    +      8.168  g /
```

Toggle to weight readout: <u>◡</u>/	+ 13.20269 g	

The ID codes		mean:
NUM	**3.0590**	sample ID number
Temp +	**20.0 'C**	temperature in °C for calculation
Rhofl +	**0.998 g /**	density calculated for liquid
Wa +	**15.03908 g**	weight in air (**Wa**)
Wfl +	**13.20269 g**	weight in fluid (**Wfl**)
Vol +	**1.841 ccm**	calculated volume of the sample
Rho +	**8.168 g /**	calculated density of the sample

Practical Example: Density Determination Using a Specific Gravity Bottle

Reference liquid: Water
Temperature: 20°C
Balance used: MC 210 P

Menu code settings used in the example:

Function	Code	
Density	2 1 7	
Tare memory	2 2 2	As an alternative, you can select
Selective CF/: F1/ / F2/	2 4 3	this code:
Method: Spec. gravity bottle	2 6 2	
Automatic output		Automatic output
of all calculated values	7 1 2	of the density (sp. gravity) 7 1 3
With data ID code	7 2 2	

Auxiliary equipment: Specific gravity bottle with a capacity of 50 ml
Sartorius YDP 03-0CE Data Printer

Application: Determination of the density of powdery
or fine-grained samples

Procedure: Distilled water at 20°C will be used as the reference
liquid. The hard copy is to be identified by the sample
ID number "K* xxx."
After pouring out the reference liquid, you do not need to dry
the specific gravity bottle, if you store the weight of the
liquid remaining in the bottle temporarily in the tare memory.

Step/Key ID/Key	Readout		Data Output/Printout
To start program			
clear functions: CF/ F1/ CF/ F2/	+	xxxxx g	
Enter sample ID no. 2.05:			
②⊙⓪⑤ i/	+	2.05	K* 2.05
Place empty spec. grav. bottle	+	xx.xxxxx g	
on pan; tare TARE/		0.00000 g	
Access program:		°C	
STO - F2/	+	20.0°	

Step/Key ID/Key	Readout	Data Output/Printout
Confirm temperature of 20°C: STO - F2/	-L- 0.00000 g	
Place spec. grav. bottle containing ref. liquid on pan; press STO - F2/ to store weight	-L- + 49.62777 g	
Empty bottle; place empty bottle on pan: TAR - F1/	-A- 0.00000 g Net	N1 + 0.20950 g
Fill bottle with sample; place on pan: - F2/	-A- + 53.39006 g Net	
Clear tare memory: ⊙, F1/	-r- + 53.59956 g	
Place bottle filled with reference liquid on pan: STO - F2/	-r- + 64.01801 g	
Read off calculated density (spec. gravity)	rHo 1.366 °	Temp + 20.0 'C Rhofl + 0.998 g / Wa + 53.39006 g Wfl + 49.62777 g Wr + 64.01801 g Vol + 39.107 ccm Rho + 1.366 g /

The ID codes			mean:
K*	2.05		sample ID number
Temp	+	20.0 'C	temperature in °C for calculation
Rhofl	+	0.998 g /	calculated density of the reference liquid
Wfl	+ 49.62777 g		weight of the sample
Wa	+ 53.39006 g		weight of the reference liquid
Wr	+ 64.01801 g		weight of the sample + reference liquid
Vol	+	39.107 ccm	calculated volume of the sample
Rho	+	1.366 g /	calculated density of the sample

Diameter Determination[1])

Diameter Determination   Code 2 1 7

Symbol displayed: ♦
Key identified by: STO - F2/

The diameter determination program offers an accurate solution to the problem
of determining the diameter of wires and metal filaments. To do this, you only need
to enter the density of the object to be weighed in the parameter mode and
the length of the object, using the numeric keys and F2/. The factory-set density
is the density of steel (8 g/cm^3).

Changing the Density of the Object to Be Weighed
You must enter the density in grams per cubic centimeter (g/cm^3).
A density may not be greater than 22.5 g/cm^3 or less than 0.1 g/cm^3.

To select the parameter mode: – Hold down i/ for more than 2 seconds
To change the setting: – Enter a numeric value
To store the value
(in the non-volatile memory):   – Press STO - F2/

Entering the Length of the Object to Be Weighed
Use the numeric keys to enter the length in millimeters of the object to be weighed,
and then store this value by pressing the F2/ key identified on the display
by "STO." Afterwards, the diameter in millimeters is calculated and displayed.
Press ⏱/ to toggle between the diameter determination program and the standard
weighing mode.

Use in Combination with Other Programs
The diameter determination program can be used in combination with other
application programs. This means that you will have all functions of the combined
program available in addition.

Program	Code		
Tare memory	2	2	2
Over/under checkweighing (net weight)	2	2	3
Over/under checkweighing (difference in weight)	2	2	4

**Important Note for Verified Balances Approved for Use as Legal Measuring
Instruments in the EU:***

You may not use the calculated diameter when the balance is being used
as a legal measuring instrument. The display symbol "R2" flashes to identify non-
verified display readouts (not legal for trade).

[1]) = not on models MC 210 S (-0CE), MC 210 P (-0CE) and MC 410 S (-0CE)
* = including the Signatories of the Agreement on the European Economic Area

Practical Example: Diameter Determination

Menu code settings used in the example:

Function	Code
Diameter determination	2 1 7
Automatic output of length and density	7 1 2
With data ID code	7 2 2

As an alternative, you can select this code:

Data output – manual mode	7 1 1*

Application: Determination of the diameter of wires and metal filaments (e.g., for tungsten or molybdenum)

Step/Key ID/Key	Readout	Data Output
Activate the parameter mode by pressing ⊥/ >2 seconds	rHo 8.000°	
Enter density for filament (in this case, tungsten): ①⑨·②⑤ Store value in the non-volatile memory by pressing STO - F2/	19.25	
Zero the balance using TARE/	0.000 mg	
Place tungsten filament on pan; close the draft shield	+ 59.423 mg	
Enter filament length, e.g., ②⓪⓪ (mm); store using STO - F2/	200 + 0.140°	L + 200 mm RhoG + 19.25 g /
Print diameter by pressing ○/	+ 0.140°	Dia + 0.140 mm
Taggle to weight readout with ⊴/	+ 59.423 mg	

The data ID codes	mean:
L + 200 mm	length of filament
RhoG + 19.25 g /	density of the object weighed (e.g., filament)
Dia + 0.140 mm	calculated diameter

* = factory setting

Tare Memory

Tara Memory

Symbol displayed when a value is stored: **Net**

Key identified by: TAR - $\underline{F1}$/

Press the $\underline{F1}$/ key identified by "TAR" to accept and store a weight on the pan or a numeric entry as a tare weight (this procedure is indicated by "Net" on the display). The balance is now tared automatically so you can weigh again starting with a zero readout.

If you have stored a value in the tare memory, a "1" will be printed or output after the ID of this value to identify it as such on the printout or on the computer screen.

By selecting the appropriate menu code, you can have the tare weight "T1" or "PT1" instead of the net weight or value "N1" automatically output via the interface once you have stored it with $\underline{F1}$/ identified on the display by "TAR."

If you combine the tare memory function with another program and have stored a value in the tare memory, a "1" will be printed or output after the ID of this value to identify it as such on the printout or on the computer screen.

Use in Combination with Other Programs

The tare memory program can be used in combination with other application programs. This means that you will have all functions of the combined program available in addition.

Program	Code					
	For MC 210 S, MC 210 P, MC 410 S (-0CE)			For MC 5 (-0CE), SC 2 (-0CE) and MC 21 S		
Counting	2	1	4	2	1	4*
Weighing in percent	2	1	5	2	1	5
Density	2	1	7	not applicable		
Diameter determination	not applicable			2	1	7

* = factory setting

Practical Example: Display/Print Tare – Net – Gross Weights

Menu code settings used in the example:

Function	Code
Tare memory	2 2 2
Automatic output of all parameters	7 1 2
With data ID code	7 2 2
Print tare memory	7 3 2

As alternatives, you can select these codes:

Automatic data output of the main parameter	7 1 3
Print net weight	7 3 1*

Application: Obtaining printouts of tare, net and gross weights or outputting these data to a computer
– with storage of a weight actually on the pan
– with storage of a weight entered on the numeric keys

Step/Key ID/Key	Readout	Data Output		
CF/, TARE/	0.000 mg			
Place container on pan	+ 122.650 mg			
Tare: TAR - F1/	0.000 mg Net	T1	+	122.650 mg
Fill container with sample ⌂/	+1059.335 mg Net	N1	+	1059.335 mg
CF/, ⌂/	+1181.985 mg	N	+	1181.985 mg
CF/, TARE/	0.000 mg			
Enter tare weight: ①②②·⑥⑤	+ 122.650			
Tare: TAR - F1/	0.000 mg Net	PT1	+	122.650 mg
Place container with sample on pan; ⌂/	+1059.335 mg Net	N1	+	1059.335 mg
CF/, ⌂/	+1181.985 mg	N	+	1181.985 mg

The data ID codes	mean:
T1 + 122.650 mg	tare memory weight (actual weight on pan)
PT1 + 122.650 mg	tare memory weight (numeric entry)
N1 + 1059.335 mg	net weight when tare weight is stored
N + 1181.985 mg	gross weight = tare weight + net weight

* = factory setting

Practical Example: Net Total

Menu code settings used in the example:

Function	Code
Tare memory	2 2 2
Automatic data output	7 1 2
With data ID code	7 2 2
Printout of individual components/tare weights	7 3 1*

As an alternative, you can select this code:

Printout of net total weight/ total tare weight	7 3 2

Application: Weighing-in several components with additive storage, automatic taring and output of the component weight

Step/Key ID/Key	Readout	Data Output
Place container on pan	122.650 mg	
CF/, TARE/	0.000 mg	
Weigh in 1 st component	+1059.335 mg	
Store: TAR - F1/	0.000 mg ᴺᵉᵗ	**N1 + 1059.335 mg**
Weigh in 2nd component	+1352.330 mg ᴺᵉᵗ	
Store: TAR - F1/	0.000 mg ᴺᵉᵗ	**N1 + 1352.330 mg**
Weigh in and store additional components	+xxxx.xxx mg ᴺᵉᵗ	**N1 + xxxx.xxx mg**
Finish weighing-in procedure; Ⓞ; F1/ Output the total weight: ☺/	+3181.985 mg ᴺᵉᵗ	**N + 3181.985 mg**

The data ID codes	mean:
N1 + 1059.335 mg	component weight (net individual weight)
N + 3181.985 mg	total amount weighed-in (net total weight)

* = factory setting

Weighing in Percent

Weighing in Percent   Code 2 1 5

Symbol displayed: %

Key identified by: STO
                    REF - F2/

This application program enables you to obtain weight readouts in percent which are based on a reference weight "Wxx%."

You can store a weight as a reference percentage "pRef" using the F2/ key, identified by "STO REF," in the following ways:
– Place a reference sample on the pan and press the function key identified by "STO REF" to have the reference weight for 100% calculated from the sample weight on the pan "Wxx%" and from the reference percentage "pRef" (shown on the application display).
– Enter a reference percentage "pRef" using the numeric keys and store it with the function key identified by "STO REF" to have the reference weight for 100% calculated based on the percentage entered and on a weight on the pan.

To change the standard percentage (value shown on the application display), either access the parameter mode or enter a different number using the numeric keys (see page 3–49). You can read the reference percentage in the application display as long as you have not yet stored the reference weight.

Use S/ to toggle between percent and weight readouts.

> **Important Note for Verified Balances Approved for Use as Legal Measuring Instruments in the EU:***
>
> You may not convert a weight into a percent when the balance is being used as a legal measuring instrument. The display symbol "R2" flashes to identify non-verified display readouts (not legal for trade).

* including the Signatories of the Agreement on the European Economic Area

Practical Example: Determination of the Residue in Percent

Menu code settings used in the example:

Function	Code
Weighing in percent	2 1 5
Ref. % and ref. weight	7 1 2
With data ID code	7 2 2

As an alternative, you can select this code:

Reference weight only	7 1 3

Application: Quick determination of the dry weight of a sample

Step/Key ID/Key	Readout	Data Output
Place container on pan	+ 122.650 mg	
CF/, TARE/	0.000 mg	
Add prepared sample to the container		
STO	+ 485.576 mg	
REF - F2/	+ 100.0 %	`pRef   +        100 %`
		`Wxx%   +   485.576 mg`
Remove container; dry sample	+ xx.x % Net	
Reweigh sample in container	+ 76.9 %	
Print percent: ◎/	+ 76.9 %	`Prc    +       76.9 %`
Toggle to residual weight readout: ⤴/	+ 373.465 mg	
Print weight ◎/	+ 373.465 mg	`N      +   373.465 mg`

The data ID codes	mean:
`pRef   +        100 %`	reference percentage
`Wxx%   +   485.576 mg`	net reference weight xx%
`Prc    +       76.9 %`	calculated percentage
`N      +   373.465 mg`	net residual weight

Weighing in Percent with Additional Requirements

Changing the Reference Percentage

The reference percentage setting is shown on the application display above the unit symbol after you have pressed CF/.

You can change the reference percentage to suit your individual requirements in one of the following ways:

– Enter a percentage using the numeric keys and store it by pressing F2/ identified on the display by "STO REF"
or
– Change the percentage in the parameter mode

To select the parameter mode:	– Hold down i/ for more than 2 seconds
To select the percentage:	– Press ^ - F1/ If you have made a mistake and need to reset the percentage, simply press the CF/ key
To store the percentage – temporarily until you turn off the balance:	– briefly press STO - F2/
– permanently after you turn off the power (in the non-volatile memory):	– press STO - F2/ for more than 2 seconds

This setting is not cancelled by the reset code 9 – – 1°!

Reference Percentage

Changing the reference percentage	Code		
No change	2	3	1
In cycles: 5, 10, 20, 50, 100, 5, 10, …	2	3	2*
In increments of one	2	3	3

Storage Parameter for the Reference Weight
(Code only for models MC 210 S (-0CE), MC 210 P (-0CE), MC 410 S (-0CE))

The reference weight is stored	Code		
with full accuracy according to the internal resolution	3	5	1
according to the display accuracy	3	5	2*

* = factory setting

Display Parameter for Readouts in Percent

If the weight stored is too light to be displayed according to display parameter set, the number of decimal places is automatically decreased.
The following display parameters can be set for readouts in percent:

The readout is displayed	Code					
	For MC 210 S, MC 210 P, MC 410 S (-0CE)			For MC 5 (-0CE), SC 2 (-0CE) and MC 21 S		
Without a decimal place	3	6	1	3	5	1
With one decimal place	3	6	2	3	5	2*
With two decimal places	3	6	3*	3	5	3
With three decimal places	3	6	4	3	5	4

Use in Combination with Other Programs

The weighing-in-percent program can be used in combination with other application programs. This means that you will have all functions of the combined program available in addition.

Program	Code		
Tare memory	2	2	2
Over/under checkweighing (net weight)	2	2	3
Over/under checkweighing (difference in weight)	2	2	4

* = factory setting

Over/Under Checkweighing [1])

This program is used to check whether products are within a specific tolerance range, to sort and classify items, and to fill and batch products. Symbols are displayed above the bar graph as visual aids for this type of program: the equal sign indicates the target weight; the minus sign, the underweight limit; and the plus sign, the overweight limit.

Within the tolerance range, the response sensitivity of the bar graph is increased. You can define the tolerance limits between 0.1% and 10% as required. To find these setting options, see the chart on page 3–53. The factory setting is for tolerance limits of +/−1.0%.
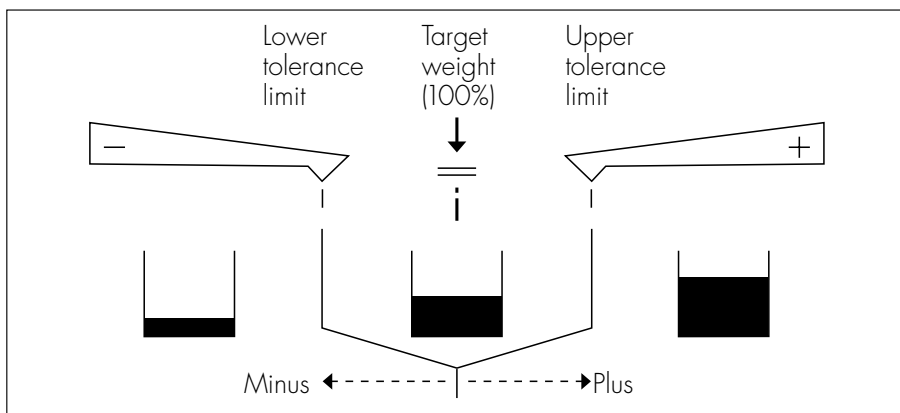
For checkweighing, you can choose between two programs:
– checking net weights   – code 2 2 3
– checking variations in weight – code 2 2 4

To store a weight readout as the target weight, press ⏻/ identified by "STO." This value can be a numeric entry or an ideal sample weight actually on the pan. The target weight is shown in the analog display as a bar graph. The last segment of this bar graph ends exactly below the equal sign of the checkweighing indication. If the weight of a product is "acceptable," the last segment of the bar graph will be within the tolerance range of the checkweighing indication.

[1]) This is also known as "plus/minus checking"

Practical Example: Checking Net Weights

Menu code settings used in the example:

Function	Code
Checking net weights	2 2 3
Control by port lines for the YRD 10 Z checkweighing display	8 7 1
Tolerance + target weight	7 1 2
With data ID code	7 2 2

As an alternative, you can select this code:

Target weight only	7 1 3

Application: Weighing-in the same amounts of samples

Step/Key ID/Key	Readout	Data Output
CF/; place sample container on pan; TARE/	0.000 mg	
Weigh in required sample amount	+ 493.110 mg	
Store: STO - F1/	1.0 %	Lim + 1.0 % Setp + 493.110 mg
	+ 493.110 mg	
Remove container + ideal sample; place another container on pan; TARE/	0.000 mg	
Weigh in sample using the analog bar graph as a guide	Checkweighing indication + 495.894 mg	
◎/	+ 495.894 mg	N + 495.894 mg

Continue as directed above

The data ID codes	mean:
Lim + 1.0 %	over/under limits in percent
Setp + 493.110 mg	target weight stored
N + 495.894 mg	net sample weight

Over/Under Checkweighing with Additional Requirements

Changing the Tolerance Limits

You can individually define the tolerance limits to be between 0.1% and 10%.

Tolerance limits	Code		
+/– 0.1% over/under deviation from the target	4	1	1
+/– 0.2% over/under deviation from the target	4	1	2
+/– 0.5% over/under deviation from the target	4	1	3
+/– 1.0% over/under deviation from the target	4	1	4*
+/– 1.5% over/under deviation from the target	4	1	5
+/– 2.0% over/under deviation from the target	4	1	6
+/– 2.5% over/under deviation from the target	4	1	7
+/– 3.0% over/under deviation from the target	4	1	8
+/– 5.0% over/under deviation from the target	4	1	9
+/– 10.0% over/under deviation from the target	4	1	10

Automatic Data Output

"Acceptable" values can be printed out or transferred automatically.
Data are output once the readout has stabilized within the tolerance limits selected.
Following data output, this function is blocked until the balance is unloaded to the extent that the weight on the pan is below the lower threshold limit, or is loaded so that the weight exceeds the upper threshold limit. The lower weight limit is approx. 30% and the upper weight limit is approx. 170% of the target weight.

Automatic output of "acceptable" values		Code		
On		4	2	1
Off	*	4	2	2

* = factory setting

Activation of the Data Output Port Lines

You can have different data output port lines – provided by the balance interface – activated according to your requirements by setting the appropriate menu code listed below.

For filling, the port lines can be activated regardless of stability. However, for standard checkweighing applications, the port lines should be activated only at stability. This increases the reading speed for an externally connected checkweighing display (YRD 10 Z).
The checkweighing range is within approx. 30% and 170% of the target weight.

Activate the port lines as follows:	Code		
Only within the checkweighing range	4	3	1*
Always	4	3	2*
Only at stability within checkweighing range	4	3	3
Only at stability	4	3	4

Use in Combination with Other Programs

The over/under checkweighing programs can be used in combination with other application programs. This means that you will have all functions of the combined program available in addition.

Program	Code					
	For MC 210 S, MC 210 P, MC 410 S (-0CE)			For MC 5 (-0CE), SC 2 (-0CE) and MC 21 S		
Counting	2	1	4	2	1	4
Weighing in percent	2	1	5	2	1	5
Differential weighing and backweighing	2	1	6	2	1	6
Density	2	1	7	not applicable		
Diameter determination	not applicable			2	1	7
Air buoyancy correction program	2	1	8	2	1	8

* = factory setting; depends on the balance model in some cases

Counting

Counting   **Code 2 1 4**

Symbol displayed: ♣

Key identified in the display as follows:
– Before the program is selected   STO
                                      REF - F2/
– During counting   OPT - F2/

The counting program allows automatic conversion of weights into piece counts based on a reference sample weight identified by "wRef."

You can store a reference sample weight and assign it to a reference sample quantity "nRef" in one of the following ways using F2/, identified in the display by "STO REF":
– Place a sample on the pan and press the function key identified by "STO REF" to have the reference sample weight "wRef" calculated from the sample weight and the reference sample quantity (piece count) "nRef" shown on the application display

or
– Enter the reference sample quantity "nRef" using the numeric keys and store it with the function key identified by "STO REF" to have the reference weight "wRef" calculated based on this sample quantity and the sample weight

The reference sample quantity selected will be indicated on the application display as long as you have not yet stored the reference sample weight.
To change the standard reference sample quantity, either access the parameter mode or enter a different number and store it by pressing F2/ identified by "STO REF" (see page 3–58).

To toggle between the piece count and the weight readout, press the toggle key labeled ⊆/.

Updating the Reference Sample Accuracy

While counting (piece count readout), you can press F2/ identified by "OPT" to update the reference sample for optimizing the accuracy (approx. double the reference sample quantity). In the process, the reference weight (average piece weight) is recalculated based on the total reference sample weight and the piece count displayed.
It makes sense to update the reference sample accuracy when the weight of the reference sample quantity is lighter than 100 digits. In this case, double the quantity of parts before you update the sample weight. You can repeat the updating procedure as often as desired.

Important Note for Verified Balances Approved for Use as Legal Measuring Instruments in the EU:*

You may not convert weights into piece counts when the balance is being used as a legal measuring instrument. The display symbol "R2" flashes to identify non-verified display readouts (not legal for trade).

* including the Signatories of the Agreement on the European Economic Area

Practical Example: Counting Small Parts

Menu code settings used in the example:

Function	Code
Counting	2 1 4
Ref. quantity and ref. weight	7 1 2
With data ID code	7 2 2

As an alternative, you can select this code:

Reference weight only	7 1 3

Application: Counting of bulk quantities of items with the same weight and with a light average piece weight

Step/Key ID/Key	Readout	Data Output
Place container on pan	+ 122.650 mg	
CF/, TARE/	0.000 mg	
Add 20 parts; enter reference sample quantity: ②⓪	+ 20	
Store: STO	+ 20 pcs	nRef + 20 pcs
REF - F2/		wRef + 5.6546 mg
To update ref. sample, add more parts (approx. 2x nRef):	+ 38 pcs	
OPT - F2/	+ 5.6591 mg	wRef + 5.6591 mg
Fill container with desired quantity of parts	+ 500 pcs	
◎/	+ 500 pcs	Qnt + 500 pcs
Toggle to weight readout: ⊴/	+2829.550 mg	
◎/	+2829.550 mg	N + 2829.550 mg

The data ID codes			mean:
nRef	+	20 pcs	reference sample quantity (piece count)
wRef	+	5.6546 mg	reference weight (average piece weight)
Qnt	+	500 pcs	calculated piece count
N	+	2829.550 mg	net weight

Counting with Additional Requirements

Changing the Reference Sample Quantity

You can change the reference sample quantity as required:

– Enter the reference sample quantity (piece count) using the numeric keys and store it with F2/ identified by "STO REF"

or

– Change it in the parameter mode

To select the parameter mode: – Hold down i/ for more than 2 seconds

To change the setting: – Use F1/ identified by "^"
    If you enter a wrong number, press CF/ to clear it

To store the reference quantity
– temporarily until you turn off
    the power: – briefly press STO - F2/
– permanently after you turn off
    the power (in the non-volatile
    memory):   – press STO - F2/ for more than 2 seconds

This setting is not cancelled by the reset code 9 – – 1°!

Reference Sample Quantity

Changing the reference sample quantity	Code		
No change	2	3	1
In cycles: 5, 10, 20, 50, 100, 5, 10, …	2	3	2*
In increments of one	2	3	3

Storage Parameter for the Reference Sample Weight
(Code only for models MC 210 S (-0CE), MC 210 P (-0CE), MC 410 S (-0CE))

The weight is stored	Code		
with full accuracy according to the internal resolution	3	5	1
according to the display accuracy	3	5	2*

* = factory setting

Error Codes for the Application Programs

These error codes enable you to identify any operator errors that occur.

Readout	Meaning	Reason/Solution
Err 10	The TARE/ key is blocked when the tare memory has a value stored.	The tare functions are interlocked with respect to each other. To release the TARE/ key, clear the tare memory of the particular function key (press CF/).
Err 11	By pressing TAR - F1/, you tried to store a value not allowed in the tare memory.	The readout was negative, for example – check the sample on the pan.
Err 12	The value you tried to store in the tare memory exceeds the weighing capacity or range limit of the balance.	Check the sample or container
Err 20	The ≤/ key was pressed before an application program was started.	For weighing in percent, a reference percentage was not yet stored, for example.
Err 21	The menu code for the reference percentage or reference sample quantity is blocked.	Code 2 3 1 is selected in the balance operating menu. Change it to 2 3 2 or 2 3 3.
Err 22	Error during storage of the reference for weighing in percent or counting	The weight is too light or a sample is not on the weighing pan.
Err 23	Error during storage while any application program was run	A sample is not on the weighing pan or the readout has a negative sign.
Err 62	F1/ was pressed at the wrong time.	Follow proper work procedure.
Err 63	You may not press the F2/ key.	Follow proper work procedure.
Err 64	You may not make an entry using the numeric keys.	Follow proper work procedure.
Err 70	Incorrect numeric entry	Enter a number within the capacity of your balance.

Readout	Meaning	Reason/Solution
Err 80	Arithmetic error occurred during the density determination program	Do not try to store "0" as the mass value.
Err 234	Initial activation of the "differential weighing and backweighing program"	Turn the balance off and back on again.
	The rechargeable battery for the "differential weighing and backweighing" memory (RAM) is decharged or defective.	Leave the balance connected to line current for approx. 12 hours to charge the battery. If this error code continues to be displayed, contact your local Sartorius Service Center.

Interface Description

This description has been written for users who wish to connect their Sartorius MC balance to a computer or a different peripheral device via the balance's standard V24/V28 RS-232C(-S)*)/423 interface.

By using an on-line computer, you can change, activate and monitor the functions of the balance and the application programs.

In addition, you can plug an external, universal remote-control switch into the data interface port to activate these functions: print (data transfer), open/close the draft shield, F1/ or F2/ key function, or tare.

The data interface also provides data output port lines for various application programs.

If you interface an original Sartorius accessory device, such as a Sartorius Data Printer or a similar unit, with a balance that has the factory-set menu codes, you do not need to change any settings.

*) = Sartorius pin assignment

General Specifications

Type of interface	Serial point-to-point connector
Operating mode	Asynchronous, full-duplex
Standard	V28, RS-232C, RS-423 specification
Handshake*)	2-wire interface: via software (XON/XOFF) 4-wire interface: via hardware handshake lines Clear To Send (CTS) and Data Terminal Ready (DTR)
Transmission rates*)	150; 300; 600; 1,200; 2,400; 4,800; 9,600; 19,200 baud
Character coding	7-bit ASCII
Parity*)	Mark**), space**), odd, even
Synchronization	1 start bit; 1 or 2 stop bits *)
Data output format*) of the balance	16 or 22 characters
Character format*)	− 1 start bit − 7-bit ASCII − 1 parity bit − 1 or 2 stop bits

*) = can be changed by the user
**) = inaccessible for verified balances approved for use as legal
       measuring instruments

Data Output Formats

Depending on the menu code setting: 7 2 1 = without data ID code
                                   or 7 2 2 = with data ID code,

data will be output with either 16 (code 7 2 1) or 22 characters (code 7 2 2).

For a data output of 22 characters, a 6-character ID, as defined in the application program selected, precedes the 16 characters.

Data Output Format with 16 Characters

Display segments that are not activated (+ or − sign, leading zeros other than zeros before the decimal point) are output as spaces.

The following data block format is output according to what is displayed on the balance:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
+	*	*	*	*	*	*	*								
	10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0			*	*	*		
	0	0	0	0	0	0	0	0							
*										*				CR	LF
		.	.	.	.	.	.	.	.		E	E	E		
−			10^6	10^5	10^4	10^3	10^2	10^1	10^0						
			0	0	0	0	0	0	0						
			*	*	*	*	*	*	*						

* = space, E = unit

When data are output without decimals, the decimal point is suppressed (except when a certain display mode is selected).

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
+			*	*	*	*	*	*							
*	*	10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0	*	*	*	*	CR	LF
−			0	0	0	0	0	0	0		E	E	E		

Data output example: +1501.117 mg

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
+	*	1	5	0	1	.	1	1	7	*	m	g	*	CR	LF

Characters:

1st	Plus or minus sign or space
2nd – 10th	Weight with a decimal point; leading zeros = space
11th	Space
12th – 14th	Unit symbol or space
15th	Carriage return
16th	Line feed

If the weighing system has not stabilized, no unit symbol is output.

For the display format parameter "last numeral off or only at stability" (blank last numeral by a rounding factor of 10 or display last numeral when the readout is stable), the 10th character in the string is a space. The reason: the last numeral without a decimal point is not blanked. Instead, it is given a definite zero, otherwise the display would go completely blank when the balance is unloaded. In this case, you will obtain the standard display format.

* = space, E = unit

Unit symbols:

* * *	No stability parameter	d w t — Pennyweights
g * *	Grams	m g * — Milligrams
k g *	Kilograms	/ l b — Parts/pound
c t *	Carats	m o m — Mommes
l b *	Pounds	K * * — Austrian carats
o z *	Ounces	t o l — Tola
o z t	Troy ounces	b a t — Baht
t l h	Hong Kong taels	MS * — Mesghal
t l s	Singapore taels	% * * — Percent
t l t	Taiwanese taels	p c s — Pieces (parts)
G N *	Grains	

Special Codes

are output only if the menu code 6 1 1, 6 1 4 or 6 1 5 is set
(see "Data Output Parameter" on page 2–18).

Special status-dependent codes

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
*	*	*	*	*	*	A	B	*	*	*	*	*	*	CR	LF

The following status codes are output for "A B":

* * : Tare   H * : Overload
C * : Calibrate**)   L * : Underload
– – : All numerals shown in stable readout

Special error-dependent codes

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
*	*	*	E	R	R	*	X	Y	Z	*	*	*	*	CR	LF

X = *, 0, 1 or 2 as a one-place error code
Y Z = Two-place error index code

* = space

**) = The displayed status code "C" will also be output when a print command
is received.

Data Output with ID Code (Menu Code 7 2 2)

When data with an ID code is output, the ID code consisting of 6 characters precedes the data with a 16-character format.

During data output, all characters are shifted to the right by 6 characters.

1st   7th   22nd character

K	K	K	K	K	K	V	x	x	x	x	x	x	x	x	x	*	E	E	E	CR	LF
	*	*	*	*	*	*	*	*	.	.	.	.	.	.				*	*		

V = Plus or minus sign
* = Space
x = Digit
E = Unit
. = Decimal point
K = Letter for an ID comment
CR= Carriage return
LF = Line feed

When special codes are output (only if menu code 6 1 1, 6 1 4 or 6 1 5 is set), the letters "Stat" for status code are assigned to the 1st through the 4th characters of the data string.

Status-dependent string:

1st   7th   13 14th   22nd character

S	t	a	t	*	*	*	*	*	*	*	*	A	B	*	*	*	*	*	*	CR	LF

Error-dependent string:

1st   7th   10 11 12th   14 15 16th   22nd character

S	t	a	t	*	*	*	*	*	E	R	R	*	X	Y	Z	*	*	*	*	CR	LF

A, B = Status codes
X   = *, 0, 1 or 2 as a one-place error code
YZ = Two-place error index code

Data Input Formats

Commands can be input via the balance interface port to control the balance and application program functions.

Control commands are distinguished according to those with upper-case letters, or special characters, and those with lower-case letters.

Format for Control Commands

Control commands can include up to 13 characters.

Each character must be transmitted with a start bit, a 7-bit ASCII-coded character, a parity bit and one or two stop bits.

You can define the parity, baud rate and handshake mode, including the number of stop bits, by programming the codes in the balance operating menu (see page 4–16).

Formate:

ESC	K	CR	LF

ESC	K	X	_	CR	LF

ESC	K	X	X	X	X	X	X	X	X	_	CR	LF
		.	.	.	.	.	.	.				

ESC = Escape
K   = Command character
X   = Number
.   = Decimal point
_   = Underline
CR = Carriage return
LF   = Line feed

The characters CR and LF do not have to be transmitted in the data string.

Control Commands with Upper-Case Letters or Special Characters

| ESC | P | CR | LF | Print; stop/start auto print |

| ESC | Q | CR | LF | Acoustic signal |

| ESC | S | CR | LF | Self-test |

| ESC | T | CR | LF | Tare |

| ESC | Z | CR | LF | Internal calibration |

| ESC | = | CR | LF | Internal linearization |

The commands "P" through "=" do not affect the code settings of the balance operating menu. The command "S" causes the processor to reinitialize (turns the balance off and back on again).

The balance will operate according to the commands available up until the processor is reinitialized. Once the balance has been turned on, the processor will always recognize the codes entered by the user in the balance operating menu.

| ESC | O | CR | LF | Block the keys |

| ESC | R | CR | LF | Release the keys |

Adaptation to Ambient Conditions

| ESC | K | CR | LF | Very stable |

| ESC | L | CR | LF | Stable |

| ESC | M | CR | LF | Unstable |

| ESC | N | CR | LF | Very unstable |

Control Commands with Lower-Case Letters

All functions that can be selected by pressing the appropriate keys on the balance can also be activated by commands.

ESC	f	0	_	CR	LF	⌐/function key

⌐/function key

ESC	f	1	_	CR	LF

F1/function key

ESC	f	2	_	CR	LF

F2/function key

ESC	f	5	_	CR	LF

⌐/function key

ESC	f	6	_	CR	LF

c/function key

ESC	s	0	_	CR	LF

i/info function key

ESC	s	3	_	CR	LF

CF/clear function key

ESC	x	0	_	CR	LF

Perform calibration test

ESC	x	1	_	CR	LF

Print/output
model number

ESC	x	2	_	CR	LF

Print/output
serial number

Numeric input

ESC	t	x	x	x	x	x	x	x	x	_	CR	LF
		.	.	.	.	.	.					

x = Any number which may include a plus or minus sign;
     can have anywhere from 1 to 8 places
. = Decimal point "." or ","
_ = Underline (ASCII = 95)

The numeric value may not have more than 8 digits (excluding the decimal point).

Each control command with lower-case letters (such as f, s, t, w and x)
must be terminated by an underline (ASCII = 95 Hex).

Computer-Controlled Operation of the Draft Shield

Control Commands for the Draft Shield on Models MC 210 S (-0CE), MC 210 P (-0CE), MC 410 S (-0CE) and MC 21 S

| ESC | w | 1 | _ | CR | LF | Open draft shield to approx. 170° |

| ESC | w | 2 | _ | CR | LF | Close draft shield |

| ESC | w | 3 | _ | CR | LF | Open draft shield as far as stored position (see also part 1, "Opening and Closing the Draft Shield") |

| ESC | w | 0 | _ | CR | LF | Poll draft shield status |

Control Commands for the Draft Shield on Models MC 5 (-0CE) and SC 2 (-0CE)

| ESC | w | 1 | _ | CR | LF | Open draft shield toward the left to approx. 100° |

| ESC | w | 2 | _ | CR | LF | Close draft shield |

| ESC | w | 3 | _ | CR | LF | Open draft shield as far as stored position (see also part 1, "Opening and Closing the Draft Shield") |

| ESC | w | 4 | _ | CR | LF | Open draft shield toward the right to approx. 100° (absolute position approx. 260°) |

| ESC | w | 0 | _ | CR | LF | Poll draft shield status |

| ESC | txxx | _ | CR | LF | ESC | f5 | _ | CR | LF | Store draft shield position xxx in degrees and the direction in which it was opened, "left" |

or

| ESC | txxx | _ | CR | LF | ESC | f6 | _ | CR | LF | Store draft shield position xxx in degrees and the direction in which it was opened, "right" |

Each control command with the lower-case letter "w" must be terminated by an underline (ASCII = 5F Hex).

Draft Shield Status

Polling the draft shield status is done to control the motor-driven draft shield door. The draft shield status will not be indicated until all movement of the draft shield door has completely stopped (draft shield motor "off").

Data Output Formats for the "Draft Shield Status"

These depend on the particular menu code setting:
code 7 2 1 "without data ID code" = data output with 16 characters,
or code 7 2 2 "with data ID code" = data output with 22 characters

Data Output Format with 16 Characters

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
*	*	*	*	*	*	W	*	0	X	X	Y	Y	Y	CR	LF

Data Output Format with ID Code (22 Characters)

With this format, the ID code "Stat" is output in the 1st through the 4th places.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
S	t	a	t	*	*	*	*	*	*	*	*	W	*	0	X	X	Y	Y	Y	CR	LF

* = space

The draft shield status consists of control codes and the turning angle of the draft shield. The control codes are identified as **xx**, and the turning angle is designated as **yyy**.

xx = Control Codes for the Draft Shield

The decimal values of bits 0 through 6 are added for the following control codes and output as a decimal number:

Decimal value		Binary value	Control code
0		Bit 0 = 0	No control error
1	2^0	Bit 0 = 1	Control error
0		Bit 1 = 0	Draft shield motor "off"
2	2^1	Bit 1 = 1	Not implemented
0		Bit 2 = 0	Not implemented
4	2^2	Bit 2 = 1	Motorized draft shield, as far as it will turn
0		Bit 3 = 0	"Self-teaching" function off
8	2^3	Bit 3 = 1	"Self-teaching" function on
0		Bit 4 = 0	Open draft shield[1]
16	2^4	Bit 4 = 1	Closed draft shield[1]
0		Bit 5 = 0	Slow speed[1]
32	2^5	Bit 5 = 1	Fast speed[1]
0		Bit 6 = 0	Motorized draft shield operation
64	2^6	Bit 6 = 1	Manual draft shield operation

[1] = These control codes refer to the previous movements of the draft shield door.

"Control Error"

The control code for "control error" is output if the draft shield door has not reached the selected position after one attempt (for mechanical reasons).
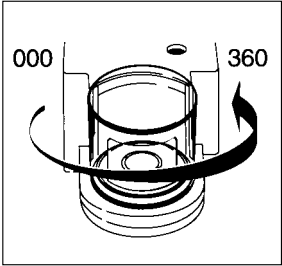
yyy = Turning Angle of the Draft Shield
The movements of the motorized draft shield door are output as a 3-place decimal number with a position readout. The readout 000 to approx. 360 corresponds to the absolute, counterclockwise position 0° to 360°.

Example: **W 008210**

Turning Angle
The draft shield door has opened to the absolute position 210°.

Control Codes

     0 → Bit 6 – motorized draft shield operation
+ 0 → Bit 4 – open draft shield
+ 8 → Bit 3 – "self-teaching" function on
+ 0 → Bit 1 – draft shield motor off
+ 0 → Bit 0 – no control error
=08

Synchronization and Data Output Parameters

Definition

During data communication between the balance and an on-line device (computer), "telegram-style" information consisting of ASCII characters is transmitted by the interface.

For error-free data communication, the interface parameters including the baud rate, parity and handshake mode, as well as the character format, must be the same for both units.
You can change these parameters in the balance operating menu so that they match those of the on-line device.
In addition to these parameter settings, you can define the data output parameter of the balance so that data are transmitted depending on various conditions – for more information, see part 2, "Utilities" starting on page 2–18.

If you do not plug a peripheral device into the interface port on the balance, this will not generate an error message. In this case, data will be output but not received.

Handshake

The balance interface (Sartorius Balance Interface = SBI) has a 23-byte transmit buffer and a 40-byte receive buffer.

You can access the balance operating menu to define various handshake parameters:

Software handshake: controlled by "XOFF" and "XON"

Hardware handshake: – after "CTS" send 2 characters
                    – after "CTS" send 1 character

What happens when you define a software handshake?

Receiving device:

"XOFF" will not be transmitted until the receive buffer has stored the 26th character. The enable command "XON" is given after the buffer has transmitted all characters up to the 14th character.

If the device addressed does not understand the control command, the SBI receiving device continues to operate additionally with a hardware handshake after it has received another 6 characters.

For data communication with a software handshake, "XON" must be sent by a device when it is turned on in order to enable another on-line device to exchange data.

Sequence:

Transmitting   Receiving device
device   (balance)

– – – – – byte – – – – →
– – – – – byte – – – – →
– – – – – byte – – – – →
  ← – – – <XOFF> – – – – –
– – – – – byte – – – – →   (Once XOFF has been transmitted, a maximum
– – – – – byte – – – – →   of 14 bytes can still be received.)
  :   :
  :   Pause :
  :   :
  :   :
  ← – – – <XON> – – – – – –
– – – – – byte – – – – →
– – – – – byte – – – – →
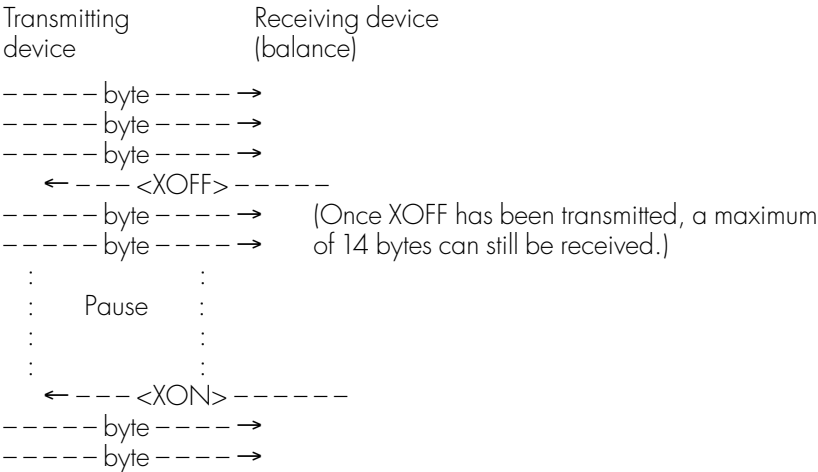
Transmitting device:

The importance of handshake control for data transmission becomes especially apparent
– when the continuous automatic data output parameter is defined
– when data output is controlled by application programs

Once <XOFF> has been received, it prevents further transmission of characters. When <XON> is received, it re-enables the transmitting device to send data. The transmitting device is always enabled for sending data after it has been switched on.

If data transmission is interrupted by the control line (CTS) or the command <XOFF> while a data block is being output from an application program (only for printing a section of text with several lines of data), the readout will be locked into the display at the same time.
Data output will be blocked until the interface receives an enabling signal.

Activating a Data Output Process

You can define the data output parameter so that output is activated either automatically, or when a print command is received. You have two options for the automatic mode: data output can be either synchronous with the balance display or activated at defined intervals (to select the parameter, see part 2, "Utilities").

Data Output by Print Command

The print command can be transmitted by a software command or by pressing the print key.

You can connect an external universal switch for remote control to the balance interface port in addition to an interface cable for a different device. For the switch, use pins 8 and 15 of this port and a cable up to 1.5 m or 5 ft. long.

If data output is requested by a software command (see the section on "Data Input Formats"), you can install a 15 m (50 ft.) cable for RS-232C or a 300 m (984 ft.) cable for RS-423.

Automatic Data Output

In the "auto print" operating mode, the data are output to the interface port without requiring a print command. You can choose to have data output automatically at defined print intervals with or without the stability parameter. Whichever parameter you choose, the data will be output as the readouts appear on the balance display.

If you select the auto print setting, data will be transmitted immediately the moment you turn on the balance. Automatic data output can be stopped and restarted either when you press the print key, or when an external print command is received, if you have set menu code 6 2 1.

These data output functions are described in part 2, "Utilities."

Interface Parameter Settings

Baud Rate		Code	
150 baud		5 1	1
300 baud		5 1	2
600 baud		5 1	3
1,200 baud	*	5 1	4
2,400 baud		5 1	5
4,800 baud		5 1	6
9,600 baud		5 1	7
19,200 baud		5 1	8

Parity		Code	
Mark parity	**	5 2	1
Space parity	**	5 2	2
Odd parity	*	5 2	3
Even parity		5 2	4

Number of Stop Bits		Code	
1 stop bit	*	5 3	1
2 stop bits		5 3	2

Handshake Mode		Code	
Software handshake		5 4	1
Hardware handshake with 2 characters after CTS	*	5 4	2
Hardware handshake with 1 character after CTS		5 4	3

*   = factory setting
**) = inaccessible on verified balances approved for use as legal measuring
        instruments

Special Interface Functions

Data Input/Output to/from the Female Interface Connector

You can plug an external switch for remote control into the female interface connector (such as foot switch YPE 01 RC with the three functions "open/close draft shield," "tare" and "print" [factory setting]).
If you change the menu code setting, you can interface both a checkweighing display (such as our color-coded YRD11Z for OVER/UNDER checkweighing) and our universal remote-control switch to your balance.

Pin assignment for the female interface connector:

Pin	Function "Inputs" (Code 8 7 2)	Function "Outputs" (Code 8 7 1)
15	Print	"Universal switch" (see below)
16	Open/close draft shield	Control output 1: lighter
17	F1/ key	Control output 2: equal
18	F2/ key	Control output 3: heavier
19	Tare	Control output 4: "set" (target)

Interface Function		Code		
Outputs	*	8	7	1
Inputs	*	8	7	2

External, Universal Remote-Control Switch (only with Code 8 7 1)

You can plug an external, universal remote-control switch into the interface port on the balance.

To change the function of this switch, set the appropriate menu code listed below.

Functions		Code		
Print		8	4	1
Tare		8	4	2
F1/ key		8	4	3
F2/ key		8	4	4
Open/close draft shield	*	8	4	5

* = factory setting; depends on the balance model in some cases

Control Lines

For classification or filling in the "over/under checkweighing" application program, you can use the voltage levels of four data output port lines to control an external on-line display or control instrument. To activate the control lines, set code 8 7 1 in the balance operating menu.

The voltage levels of the data output ports will change according to various patterns, depending on the reference weight and on the lower and upper weight limits.
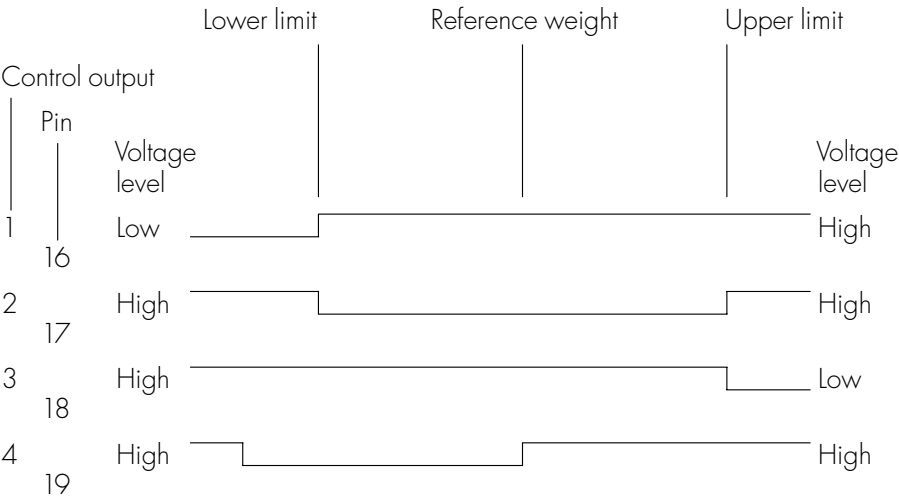
Control output 1: lighter
Control output 2: equal
Control output 3: heavier
Control output 4: "set" (target)

Pin Assignment Chart

Female Interface Connector:

25-position D-submini, DB25S, with screw lock hardware for cable gland

Male Connector Required: (please use connectors with the same specifications)

25-pin D-submini, DB25S, with shielded cable clamp assembly
(Amp type 826 985-1C) and fastening screws (mate screws for female screw lock,
Amp type 164 868-1)

Pin Assignment:

Pin 1: Signal Ground
Pin 2: Data Output (T×D)
Pin 3: Data Input (R×D)
Pin 4: "Signal Return" (T×D/R×D)
Pin 5: Clear to Send (CTS)
Pin 6: Internally Connected
Pin 7: Internal Ground
Pin 8: Internal Ground
Pin 9: Reset _ In**)
Pin 10: −12 V
Pin 11: +12 V
Pin 12: Reset _ Out**)
Pin 13: +5 V
Pin 14: Internal Ground
Pin 15:
Pin 16:
Pin 17:
Pin 18:
Pin 19:
Pin 20: Data Terminal Ready (DTR)
Pin 21: Supply Voltage Ground "COM"
Pin 22: Not Connected
Pin 23: Not Connected
Pin 24: Supply Voltage Input +15..25 V
Pin 25: +5 V

Print/Universal Switch*)

Open/Close Draft Shield Control Output 1*)

F1/ Key/ Control Output 2*)

F2/ Key/ Control Output 3*)

Tare/ Control Output 4*)
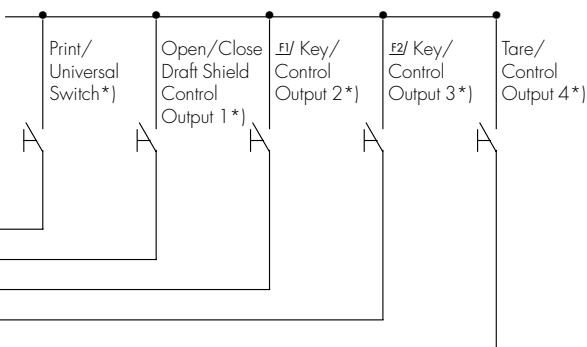
*) = to change the pin assignment, see "Data Input/Output to/from the
      Female Interface Connector" on page 4−17
**) = hardware restart

Cabling Diagrams

Diagram for interfacing a computer or a different peripheral device to the computing device (balance) using the RS-232 C/V24 standard and interface cables up to 15 m (50 ft.) long

Balance   Peripheral device (PC)
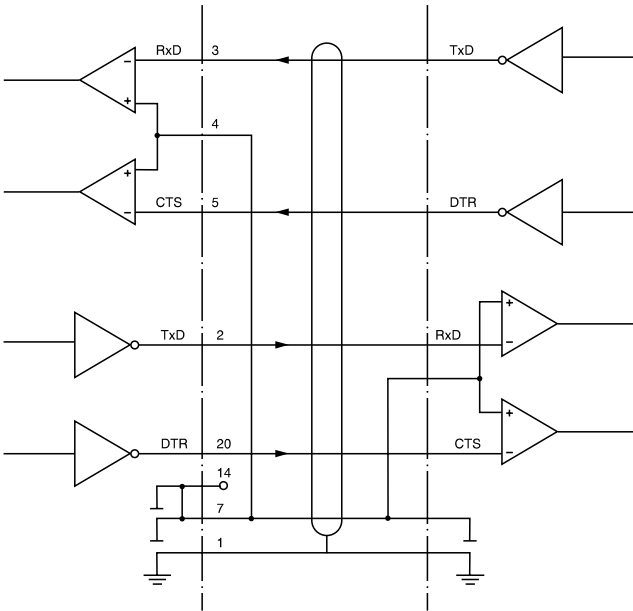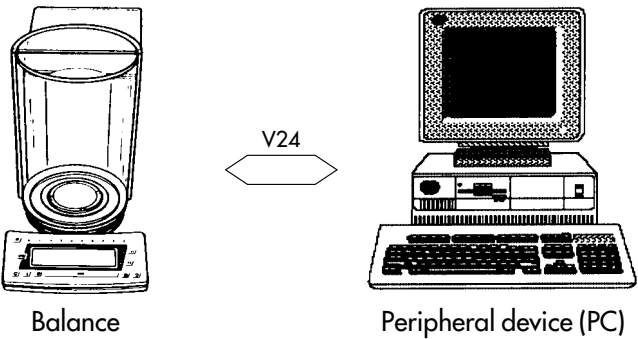
Type of cable: AWG 24 specification

Diagram for interfacing a peripheral device to the computing device using the RS-423/V10 standard and interface cables up to 300 m (984 ft.) long

Balance   Peripheral device (PC)
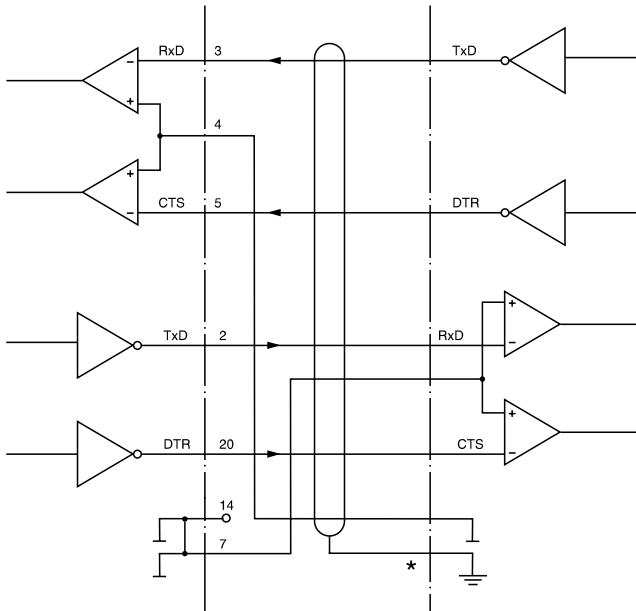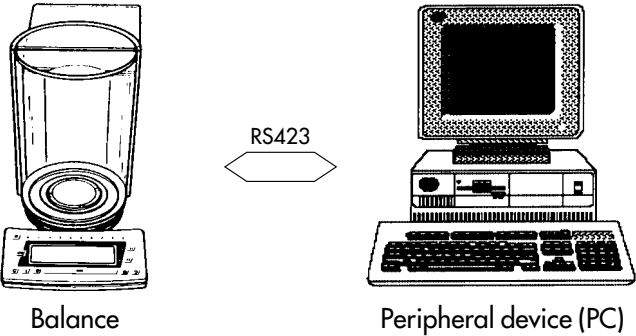
Type of cable: AWG 24 specification

*) = The protective ground is on one side only.

Specifications
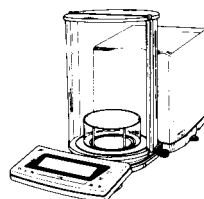
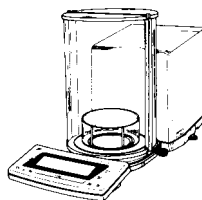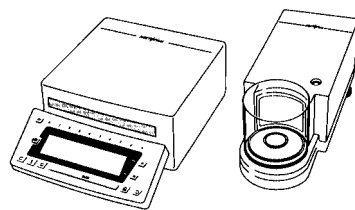| Model		MC 210 S	MC 210 P	MC 410 S
Weighing range structure		SuperRange	PolyRange	SuperRange
Weighing capacity	g	210	60/110/210	410
Readability	mg	0.01	0.01/0.02/0.05	0.1
Tare range (subtractive)	g	210	210	410
Repeatability (standard deviation)*	mg	≤±0.015/ 0.02/0.03	≤±0.02/0.4/ 0.5	≤±0.15
for weighing range	g	0–50/50–100 100–210	0–50/50–100/ 100–210	
Linearity	mg	≤±0.12	≤±0.15	≤±0.5
Linearity within 5 g	mg	≤±0.02	≤±0.02	
Response time (average)	s	◄——— ≤10 ———► ◄— ≤2.5 —►		
Response time in the IQ-mode (0.01%)	s	◄——— 2.5 ———► ◄— 1.5 —►		
Adapt. to ambient condit. and applic. requirem.		◄— By selection of 1 of 4 optimized filter levels —►		
Display update (dep. on the filter level select.)		◄——————— 0.2–0.4 ———————►		
Allowable ambient operating temperature range	°C	◄——————— +5…+40 ———————►		
Operating temperature range	°C	◄——————— +10 … +30 ———————►		
Sensitivity drift within +10…+30°C	/°C	◄——————— ≤±1 · 10⁻⁶ ———————►		
Pan size	mm	◄——————— 90 ———————►		
Weighing chamber (Ø x H), approx.	mm	◄——————— 167 x 245 ———————►		
Net weight, approx.	kg	◄——————— 12 ———————►		
Power requirements	V~	STNG6 power supply (AC adapter), 230 VAC or 115 VAC, −20%…+15%		
Frequency	Hz	◄——————— 48–60 ———————►		
Power consumption, approx.	VA	◄——— maximum: 28; average: 16 ———►		
Selectable weight units		g, kg, ct, lb, oz, ozt, tlh, tls, tlt, GN, dwt, mg, /lb, tlc, mom, K, tol, bat, MS		
Application programs		Mass unit conversion; "EUREKA" air buoyancy correction progr.; diff. weighing and backweighing; density determination; tare memory; net total; weighing in percent; over/under checkweighing (classification and filling); counting		
Automatic zero tracking function, can be turned off by menu code		◄——————— Standard ———————►		
Built-in interface		RS-232 C-S/V24-V28, RS-423/V 10; 7-bit; parity: even, mark, odd, space; trans. rates: 150…19,200 baud; 1 or 2 stop bits; software/hardware handshake		
Standard features/equipment supplied				
Dust cover/power supply		x	x	x
Hanger for below-balance weighing		x	x	x
Self-calibrating function "isoCAL"		x	x	x
ISO/GLP recording capability/numeric keys		x	x	x

* = Standard deviation of the reproducibility according to DIN 1319, Part 3

Specifications

Model		MC 21 S
Capacity	g	21
Readability	µg	1
Tare range (subtractive)	g	−21
Repeatability (standard deviation)*	µg	2
Linearity	µg	≤±15
Response time (average)	s	10
Response time in IQ mode (0.01%)	s	≤± 2.5
Adaptation to ambient conditions		By selection of 1 of 4 optimized filter levels
Display update (depends on the filter level selected)	s	0.1−0.4
Operating temperature range	K	278…313 (+5…+40°C)
Sensitivity drift within 278…313K	/K	≤ 1 · 10⁻⁶
Calibration weight		internal
Allowable ambient temperature range	°C	+5°C…+40°C
AC power source/power requirements	V~	Via AC adapter TNG6 230 or 115, +15%…−20%
Frequency	Hz	50–60
Power consumption (average)	VA	max.: 18.7, average: 11
Selectable weight units		g, kg, ct, lb, oz, ozt, tlh, tls, tlt, GN, dwt, mg, /lb, tlc, mom, K, tol, bat, MS
Weighing pan diameter	mm	30
Maximum sample size	mm	30×40
Net weight, housing, approx.	kg	11
Housing dimensions (W×D×H)	mm	219×408×318
Net weight, evaluation system, approx.	kg	3.1
Evaluation system (W×D×H)	mm	213×306×107
Built-in interface		RS-232 C-S/V24-V28, RS423/V10; 7-bit; parity: even, odd; mark, space; Transmission rates: 150…19,200 baud; 1 or 2 stop bits; software/hardware handshake
Selectable application programs		Mass unit conversion; "EUREKA" air buoyancy correction progr.; diff. weighing and backweighing; density determination; tare memory; net total; weighing in percent; over/under checkweighing (classification and filling); counting
Automatic zero tracking function (can be turned off by menu code)		Standard feature

* = standard deviation of repeatability according to German Industrial Standard (DIN) 1319, Section 3
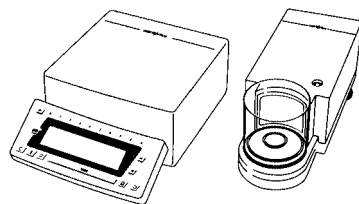
Model		MC 5	SC 2
Weighing capacity	g	5.1	2.1
Readability	µg	1	0.1
Tare range (subtractive)	g	−5.1	−2.1
Repeatability (standard deviation)*	µg	≤1	≤0.25
Linearity	µg	≤±4	≤±0.9
Linearity within 500 mg	µg	≤±2	≤±0.4
Response time (average)	s	◄——————— ≤10 ———————►	
Response time in the IQ-mode (0.01%)	s	◄——————— ≤2.5 ———————►	
Adaptation to ambient conditions and application requirements		◄ By selection of 1 of 4 optimized filter levels ►	
Display update (depends on the filter level selected)	s	0.1–0.4	0.2–0.4
Operating temperature range	K	◄——— 278...313 (+5 ... +40°C) ———►	
Sensitivity drift within 278 ... 313K	/K	◄——————— ≤1·10⁻⁶ ———————►	
Deviation of the readout when balance is tilted 1 : 1,000	µg	<± 5	<± 3
Pan size	mm	Ø 30	Ø 20
Draft shield height	mm	◄——————— 122 ———————►	
Net weight, approx. – Weighing cell – Evaluation system	kg kg	◄———————3.3———————► ◄———————3.1———————►	
Power requirements	V~	TNG6 power supply, 230 or 115, +15%...−20%	
Frequency	Hz	◄——————— 50–60 ———————►	
Power consumption incl. power supply, approx.	VA	◄———18.7: maximum; 11: average———►	
Selectable weight units		g, kg, ct, lb, oz, ozt, tlh, tls, tlt, gr, dwt, mg, /lb, tlc, mom, K, tol, bat, MS	
Application programs		Mass unit conversion; "EUREKA" air buoyancy correction; differential weighing and backweighing; diameter determination; tare memory; net total; weighing in percent; over/under checkweighing (classification and filling); counting	
Automatic zero tracking device, can be turned off by menu code		◄——————— Standard ———————►	
Built-in interface		RS-232 C-S/V24-V28, RS-423/V 10; 7-bit; parity: even, mark, odd, space; transmission rates: 150...19,200 baud; 1 or 2 stop bits; software/hardware handshake	

* = Standard deviation of the reproducibility according to DIN 1319, Part 3

Specifications
for Verified Balances
with an EC Type Approval

Model		MC 210 S -0CE	MC 210 P -0CE	MC 410 S -0CE
Type		KB BA 100	KB BA 100	KB BA 100
Accuracy class		①	①	①
Weighing range structure		SuperRange	PolyRange	SuperRange
Maximum capacity Max*	g	210	210	410
Scale interval d*	mg	0.01	0.01/0.02/0.05	0.1
Verification scale interval e*	mg	1	1	1
Minimum capacity Min*	mg	1	1	10
Tare range (subtractive)	%	◄─────── ≤105 of Max ───────►		
Range of use according to Directive No. 90/384/EEC*	g	0.001–210	0.001–210	0.001–410
Response time (average)	s	◄────── 10 ──────►◄── 2.5 ──►		
Adaptation to ambient conditions and application requirements	s	◄── By selection of 1 of 4 optimized filter levels ──►		
Display update (dep. on the filter level select.)		◄─────── 0.2–0.4 ───────►		
Allowable ambient operating temperature	°C	◄─────── +5...+40 ───────►		
Operating temperature range	°C	◄─────── +10 ... +40 ───────►		
Pan size	mm	◄─────── Ø 90 ───────►		
Weighing chamber approx., (Ø x H)	mm	◄─────── 167 x 245 ───────►		
Net weight, approx.	kg	◄─────── 12 ───────►		
Power requirements	V~	TNG6 230 VAC or 115 VAC, −20%...+15%		
Frequency	Hz	◄─────── 48–60 ───────►		
Power consumption approx.	VA	◄─────── maximum: 28; average: 16 ───────►		
Selectable weight units		g, mg		
Selectable application programs		Mass unit conversion; "EUREKA" air buoyancy correction progr.; diff. weighing and backweighing; density determination; tare memory; net total; weighing in percent; over/under checkweighing (classification and filling); counting		
Automatic zero tracking function (can be turned off by menu code)		◄─────── Standard ───────►		
Built-in interface		RS-232 C-S/V24-V28, RS-423/V 10; 7-bit; parity: even, odd; transmission rates: 150...19,200 baud; 1 or 2 stop bits; software/hardware handshake		
Standard features/equipment supplied				
Dust cover/power supply		x	x	x
Hanger for below-balance weighing		x	x	x
Self-calibrating function "isoCAL"		x	x	x
ISO/GLP recording capability/numeric keys		x	x	x
Numeric keys		x	x	x

* = EC Directive No. 90/384/EEC for non-automatic weighing instruments applicable in the EC/EU Member States

Model		MC 5-0CE	SC 2-0CE
Type		◄─────────── KC BA 100 ───────────►	
Accuracy class*		◄─────────── Ⓘ ───────────►	
Maximum capacity Max*	g	5.1	2.1
Actual scale interval d*	µg	1	0.1
Verification scale interval e*	mg	◄─────────── 1 ───────────►	
Minimum capacity Min*	mg	0.1	0.01
Tare range (subtractive)	g	◄────── < 105% of Max──────►	
Response time (average)	s	◄─────────── ≤ 10 ───────────►	
Adaptation to ambient conditions and application requirements		◄──By selection of 1 of 4 optimized filter levels ──►	
Display update (depends on the filter level selected)	s	0.1−0.4	0.2−0.4
Allowable operating temperature range – when the fully autom. self-calibr. funct. "isoCAL" is on	°C	◄─────────── 0 … +40 ───────────►	
– when the fully autom. self-calibr. funct. "isoCAL" is off	°C	◄─────────── +15 … +25 ───────────►	
Pan size	mm	Ø 30	Ø 20
Height of draft shield	mm	◄─────────── 122 ───────────►	
Net weight, approx. – Weighing cell	kg	◄─────────── 3.3 ───────────►	
– Evaluation system	kg	◄─────────── 3.1 ───────────►	
Power requirements	V~	TNG6 portable power supply, 230 or 115,+15%…−20%	
Frequency	Hz	◄─────────── 50−60 ───────────►	
Power consumption, incl. power supply, approx.	VA	◄──────18.7: maximum; 11: average──────►	
Selectable weight units		◄─────────── Milligrams and grams ───────────►	
Selectable application programs		Mass unit conversion; "EUREKA" air buoyancy correction; differential weighing and backweighing; diameter determination; tare memory; net total; weighing in percent; over/under checkweighing (classification and filling); counting	
Automatic zero tracking device, can be turned off by menu code		◄─────────── Standard ───────────►	
Built-in interface		RS-232 C-S/V24-V28, RS-423/V 10; 7-bit; parity: even, odd; transmission rates: 150…19,200 baud; 1 or 2 stop bits; software/hardware handshake	

* = EC Directive No. 90/384/EEC for non-automatic weighing instruments applicable in the
    EC/EU Member States

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

**Third Supplement to EC Pattern Approval
Approval Certificate No. D93-09-148**

**Non-automatic weighing instrument
types KB BA 100, KC BA 100, MC BA 100, MC BB 100 and
MD BA 100**

issued by	Physikalisch-Technische Bundesanstalt
in accordance with	§ 13 of the Verification Act of March 23, 1992 (Fed.Law Gazette I p. 711) and § 7c(2) of the Verification Ordinance of August 12, 1988, in the version at present in force, which comply with the Directive 90/384/EEC
issued for	Sartorius AG Weender Landstrasse 94-108 37075 Göttingen Federal Republic of Germany
for	non-automatic electromechanical weighing instrument, accuracy class I Max 1 g to 1210 g; or 5 Kt to 6050 Kt number of verification scale intervals: n ≤ 410 000
valid until	October 18, 2003

The main characteristics, conditions for approval and general
conditions are given in the Appendix which is an integral
part of the certificate and comprises 3 pages.

By order:
sgd. Brandes

Braunschweig, May 26, 1995   (Brandes)
Journal No.: 1.13-95.120

Name and address of notified body: (official stamp)
Physikalisch-Technische Bundesanstalt
Bundesallee 100
D 38116 Braunschweig, Federal Republic of Germany

Accessories (Options)
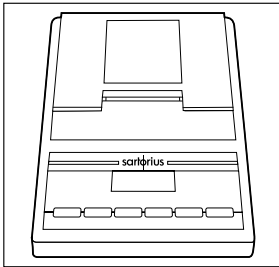
Data printer
with date/time and statistics
functions – approved for legal
metrological verification
Print speed approx. lines/sec.

Printer housing (W x D x H)
in mm
in inches

YDP 03-0CE

1.5

150 x 138 x 43
5.9 x 5.4 x 1.7
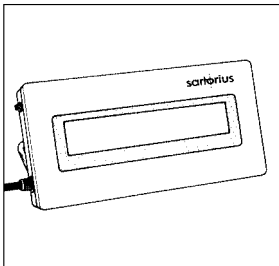
Remote display (can be plugged
into the interface port)
– LCD, reflective   **YRD 12 Z**
– LCD for overhead projectors,
  transmissive   **YRD 13 Z**

**Important Note for Verified
Balances Approved for Use
as Legal Measuring Instruments
in Europe:** The remote display
may not be connected when
the balance is being used as
a legal measuring instrument.

**External rechargeable
battery pack**   YRB 05 Z
Approx. 10 hours of operation;
rechargeable by power supply
(detailed information on additional
options for powering the balance
is available in our
Service Information bulletin 15/88)

**Foot switch with T-connector, for
carrying out 3 functions:**
open/close draft shield,
tare and print   YPE 01 RC

Accessories (Options)

Universal remote-control switch
with menu-definable ⚪/, TARE/,
F1/ / F2/ key or open/close
draft shield function

Foot switch with T-connector	YFS 01
Hand switch with T-connector	YHS 01
T-connector	YTC 01

Weighing bowls and trays
– Stainless steel
  (chromium nickel), 20 g   **6003**
– Glass, 20 g   **6015**
– Stainless steel, 300 ml,
  with pouring spout   **6407**

**Pure aluminum weighing
bowls and scoops**
– 2.7 x 4 x 12 mm, approx.
  4.5 mg (250 per package)   **6565**
– 6.5 x 7 x 25 mm, approx.
  52 mg (200 per package)   **6566**

Draft shield cover with pipette opening
for MC 210 S, MC 210 P
and MC 410 S (-0CE)   YDS 01 RC

Pipette calibration set   Information
on request

Balance table
– with cast stone slab inset   YWT 01
– made entirely of cast stone   YWT 03

Digital/analog converter   YDA 01 Z

IEC converter   7253 16

RS-422 converter   7253 19

Accessories (Options)

SartoWedge data transfer software program   YSW 01
enables you to have data, recorded by your balance, input
directly into any application program you are running on your
PC (e.g., Excel). Memory-resident software (5 KB) for all
IBM-compatible computers and balances that are equipped
with a serial interface.
This applications kit includes the following software
and equipment:
– 3½" or 5¼" program diskette
– Interface cable
– Manual

BalanceReader software   YAK 10 PC-0002
for collecting data that are transmitted by your Sartorius
balance to a commercially available personal computer.
These data are read into spreadsheets and stored.
The stored spreadsheet can be further processed/edited
using standard software available on the market (Excel,
Lotus 1-2-3, etc.). This applications kit includes the following
software and equipment:
– 3½" and 5¼" program diskettes
– Program description
– Interface cable
– Adapter (25-pin to 9-pin)

Weight set for air density determination, with certificate
– for MC 210 S, MC 210 P (-0CE), MC 410 S (-0CE)   **YSS 45**
– for MC 5, MC 5-0CE   **YSS 35**

Density determination kit   **YDK 01**
– for MC 210 S, MC 210 P and MC 410 S (-0CE)   **YDK 01-0D**

Antistatic pan for weighing electrostatically charged samples
– for MC 210 S, MC 210 P and MC 410 S (-0CE)   **YWP 01**

Ionizing blower
This ionizing blower neutralizes static electricity
by "bombarding" the sample with ions
– for 230 V line current (mains)   **YIB01-0DR**
– for 110 V line current (mains)   **YIB01-0UR**

Declarations of Conformity

The C€ Mark on Sartorius Equipment

In 1985, the Council of the European Community approved a resolution concerning a new approach to the technical harmonization and standardization of national regulations. The organization for monitoring compliance with the directives and standards concerning C€ marking is governed in the individual EU Member States through the implementation of the EC Directives adopted by the respective national laws. As of December 1993, the scope of validity for all EC Directives has been extended to the Member States of the European Union and the Signatories of the Agreement on the European Economic Area.

Sartorius complies with the EC Directives and European Standards in order to supply its customers with weighing instruments that feature the latest advanced technology and provide many years of trouble-free service.

The C€ mark may be affixed only to weighing instruments and associated equipment that comply with the following Directive:

Council Directive 89/336/EEC "Electromagnetic Compatibility (EMC)"

This Directive regulates the use of equipment that can cause electromagnetic interference or whose functioning can be influenced by such interference.

Applicable European Standards:

Limitation of emissions	EN 50081-1	Residential, commercial and light industry
	EN 50081-2	Industrial environment
Defined immunity to interference	EN 50082-1	Residential, commercial and light industry
	EN 50082-2	Industrial environment

Important Note:

The operator shall be responsible for any modifications to Sartorius equipment and for any connections of cables or equipment not supplied by Sartorius and must check and, if necessary, correct these modifications and connections.
On request, Sartorius will provide information on the minimum operating specifications (in accordance with the Standards listed above for defined immunity to interference).

Additional Directive for Weighing Instruments Used in Legal Metrology:
Council Directive 90/384/EEC "Non-Automatic Weighing Instruments"
This Directive regulates mass determination in legal metrological applications, e.g., in
– the manufacture of pharmaceuticals
– medicine and health care
– calculation of fees
– price calculation

For the respective Declaration of Type Conformity for weighing instruments approved for use as legal measuring instruments with an EC Type-Approval Certificate, see page 6–4.
This Directive also regulates the performance of the EC verification by the manufacturer, provided that an EC Type-Approval Certificate has been issued (see page 5–5) and the manufacturer has been accredited by an officer of a Notified Body registered at the Commission of the European Community for performing such verification.
On February 15, 1993, Sartorius AG received accreditation for performing verification.

For information on the C€ mark on Sartorius equipment and legal regulations currently applicable in your country, and to obtain the names of the persons to contact, please ask your local Sartorius office, dealer or service center.

"EC Verification –
A Service Offered by Sartorius

Our service technicians authorized to perform
the verification* of your weighing instruments which
are acceptable for legal metrological verification
can inspect and verify the metrological specifications
at the place of installation within the Member States
of the European Union and the Signatories of the
European Economic Area.

"New Installation" Service
Initial verification is covered in our "New Installation"
service package. In addition to initial verification, this
package provides you with a series of important
services which will guarantee you optimal results
in working with your weighing instrument:
– Installation
– Startup
– Inspection
– Training
– Initial verification

**If you would like Sartorius to perform initial
verification of your weighing instrument, contact an
authorized service representative. Please refer
to your nearest Sartorius European Service Center.**

Subsequent Verifications within the European Countries
The validity of the verification will become void
in accordance with the national regulations of
the country in which the weighing instrument is used.
For information on verification and legal regulations
currently applicable in your country, and to obtain
the names of the persons to contact, please contact
your local Sartorius office, dealer or service center.

* = in accordance with the accreditation certificate
received by Sartorius AG

DECLARATION OF TYPE CONFORMITY
to Directive No. 90/384/EEC

This declaration is valid for non-automatic electromechanical weighing instruments for use in legal metrology. These weighing instruments accepted for legal metrological verification have an EC Type-Approval Certificate. The model(s) concerned is(are) listed below along with the respective type, accuracy class, and number of the EC Type-Approval Certificate:

Model	Type	Accuracy Class	EC Type-Approval Certificate No.
MC...-0CE	KB BA 100	①	D93-09-148
MC...-0CE	KC BA 100	①	D93-09-148
SC...-0CE	KC BA 100	①	D93-09-148

SARTORIUS AG declares, at its sole responsibility, that its weighing instrument types comply with the regulations of the Council Directive for Non-Automatic Weighing Instruments, No. 90/384/EEC of 20 June 1990; the associated European Standard "Metrological aspects of non-automatic weighing instruments," No. EN 45501; the amended, currently valid versions of the national laws and decrees concerning legal metrology and verification in the Member States of the European Union, the EU, and the Signatories of the Agreement on the European Economic Area, which have adopted this Council Directive into their national laws; and with the requirements stipulated on the Type-Approval Certificate for verification. This Declaration of Type Conformity is valid only if the ID label on the weighing instrument has the CE mark of conformity and the green metrology sticker with the stamped letter "M" (the two-digit number in large print stands for the year in which the mark has been affixed):

$$\text{C}\,\text{C}\,\boxed{98_{0111}}\quad\boxed{M}$$
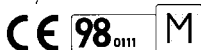
If these marks are not on the ID label, this Declaration of Type Conformity is not valid. Validity can be obtained, for example, by submitting the weighing instrument for final action to be taken by an authorized representative of SARTORIUS AG.

The period of validity of this Declaration of Type Conformity shall expire upon any tampering with, repair or modification of this weighing instrument or, in some Member States, on the date of expiration.

The operator of this weighing instrument shall be responsible for obtaining an authorized renewal of the verification, such as subsequent or periodic verification, of the weighing instrument for use as a legal measuring instrument.

Signed in Goettingen on this day of January 6, 1998

<div align="center">

SARTORIUS AG
37070 Goettingen
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</div>

Executive Board
(Dr. Claassen)

Head of Technical Operations
(Dr. Maaz)

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Index

sartorius

Brief Instructions for Sartorius Micro
for Standard Models and Models Verified

Key Functions

| Key	Function
CF/	Clears a function
I/◊/	Turns the balance on or off
◊/ / C/	Opens draft shield towards left/right
i/	Displays info in an application prog.
◡/	Toggles between weight units and readability
TARE/	Zeros the display
F1/	Quick-CAL/depends on the application program selected
F2/	Depends on the application program selected
◎/	Data output (print)

Simple Weighing

– Press ◊/ or C/ to open draft shield

– Place container on pan; then press TARE/

– Press ◊/ or C/ to open draft shield

– Add sample to container

– Press ◊/ or C/ to close draft shield

– Wait until the stability symbol "g" or "mg" is displayed; then read off weight

To adapt your balance to ambient conditions and to your special requirements, please set the appropriate codes in the balance operating menu.

Setting a Menu Code

Turn off the balance; then turn it back on again. While all segments are displayed, briefly press TARE/.

If "**- L -**" is displayed, change to "**- C -**" using the menu access switch (on the rear panel of the balance computing device).	
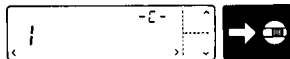
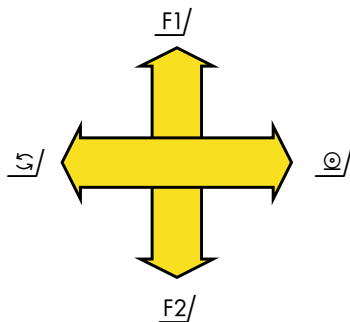Use the 4 "direction" keys to select a menu code (see diagram on the right)
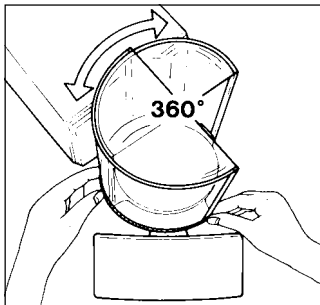
Confirm your selection: TARE/

As the last step,

change display back to "**- L -**": ⊕←

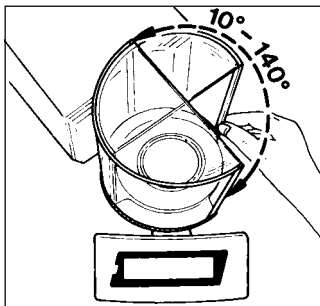To store a menu code change: press CF/

Adjusting the External Draft Shield Element on MC 210 S, MC 210 P and MC 410 (-0CE)

The draft shield consists of two semicylindrical elements. Grasp the lower riffled part of the element to turn it to the position you desire.

In addition, you can move the swivel-mounted display to the position you desire ($+/- 85°$).

### Adjusting the Aperture Angle of the Draft Shield

A narrow aperture angle will reduce the effects of drafts, allowing the balance readout to stabilize faster.

To define the aperture angle, manually adjust the draft shield door to the opening position you desire. Press ⊆/ or ⊇/ to close the draft shield automatically.
This stores the aperture angle you have just adjusted.
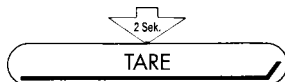Press ⊆/ or ⊇/ again, and the draft shield will now open to the position you selected.

Calibration

Internal when "CAL I" is displayed:
Clear weighing pan
Tare
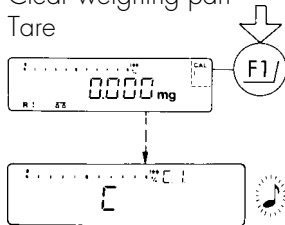
An acoustic signal indicates the end of calibration
Display: 0.000 mg

External:
Clear weighing pan

Hold down TARE/ for 2 sec. until the following appears:

Choose "C.E." for external calibration
Tare

If necessary, enter certified weight value using the numeric keys:

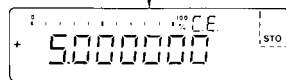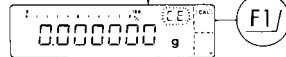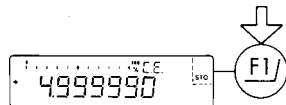Center required weight on the weighing pan

Linearization

Internal:
Clear weighing pan
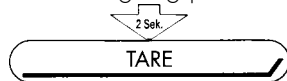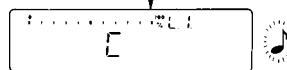

Hold down TARE/ for 2 seconds until the following appears:

Choose "L.I." for internal linearization
Tare
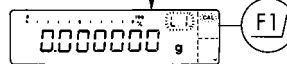
An acoustic signal indicates the end of linearization
Display: 0.000 mg

"EUREKA" Air Buoyancy Correction Program

Application: Manufacture of alloys according to stoichiometric proportions (for example, determination of masses to ensure that the quantities weighed remain in exact proportions)

Menu codes required	Code
"EUREKA" air buoyancy correction program	2 1 8
Automatic data output	7 1 2
With data ID code	7 2 2

Because of air buoyancy, samples or objects with the same mass but different densities have different weights.

– Place container on pan; then press TARE/
– Enter density for first sample using the numeric keys and confirm by pressing STO - F2/
– Add sample and press ⊙/
– Press TARE/ to zero the display
– Enter density for second sample using the numeric keys and confirm by pressing STO - F2/
– Add second sample and press ⊙/
– Press ⊆/ to toggle between weight and mass

Use the Sartorius Data Printer YDP 02-0CEV2 to generate traceable hard copies of data at your work area.

Printout:

```
RhoL  +      1.200 kg/
RhoG  +        5.32 g /

m     +    500.000 mg

RhoL  +      1.200 kg/
RhoG  +         8.4 g /

m     +   1921.875 mg
```

The Most Important Menu Code Settings

These charts summarizing the menu parameters are intended to give you a quick reference guide.

The most important menu codes for the weighing mode:

Ambient conditions	Code		
Very stable	1 1 1	
Stable	1 1 2	*
Unstable	1 1 3	
Very unstable	1 1 4	

Weighing/filling	Code		
Standard weighing	1 2 1	*
Filling	1 2 2	

Stability range
When the stability symbol (unit symbol) is displayed, the weight readout is stable within the range defined in digits.

	Code		
0.25 digit	1 3 1	
0.5 digit	1 3 2	
1 digit	1 3 3	*
2 digits	1 3 4	*
4 digits	1 3 5	
8 digits	1 3 6	

Tare parameter	Code		
At any time**	1 5 1	
At stability	1 5 2	*

Auto Zero	Code		
On	1 6 1	*
Off	1 6 2	

Weighing in 3 ranges	Code		
One range	2 1 1	
Two ranges	2 1 2	*
Three ranges	2 1 3	*

Data Output

Data ID code	Code		
Without	7 2 1	*
With	7 2 2	

Parameters	Code		
Without stability	6 1 1	
After stab. w/storage	6 1 2	*
At stab. w/o stor.	6 1 3	
Auto w/o stability	6 1 4	
Auto w/stability	6 1 5	

ISO/GMP Printout/Record

Weights, other measured values, and the data of calibration or linearization operations, along with the date, time and serial number of the particular balance are output automatically via the data interface (code 7 2 2 must also be set)

	Code		
Off	8 10 1	*
Only for cal. functions	8 10 2	
For all functions	8 10 3	

Additional Functions

Access to menu	Code		
Accessible	8 1 1	
Access denied	8 1 2	*

Beep (acoustic signal)	Code		
On	8 2 1	*
Off	8 2 2	

* = factory setting; depends on the balance model in some cases
** = does not apply to balances approved for use as legal measuring instruments

Calibration and Linearization Functions

Calibration test	Code **
Accessible	1 11 1 *
Access denied	1 11 2

External linearization**	Code
Accessible	1 12 1
Access denied	1 12 2 *

Multiple calibration mode	Code
Number of cal. procedures is indicated in the 3rd place of display, e.g. "C.I.**5**"	
Off	1 14 1 *
On	1 14 2

Self-calibrating and linearizing function "isoCAL"	Code
Off	1 15 1
Calibration status only**	1 15 2
Self-calibration "isoCAL"	1 15 3 *
Self-calibration "isoCAL" + linearization	1 15 4

Quick-CAL with F1/	Code
Internal calibration "CAL I"	2 25 *
Calibration test "CAL T"	2 26

* = factory setting
** = does not apply to balances approved for use as legal measuring instruments

Air Density Determination

For highly precise analyses, the balance offers you a function with which fluctuations in the air density can be determined. During the "EUREKA" air buoyancy correction program, the air density is used to automatically calculate the true mass (weight) of the sample/object being weighed. For determining air density, use the special weight set which is available as an accessory. This weight set consists of one steel and one aluminum weight. Via a differential method, the air density is determined with the two weights.

	Code
Accessible	1 16 1
Access denied	1 16 2 *

Application Programs

Program	Key	Code
Counting	F2/	2 1 4
Weighing in %	F2/	2 1 5
Diff. weighing + backweighing	F2/	2 1 6
Density (only for MC 210 S, MC 210 P, MC 410 S (-0CE), MC 21 S	F2/	2 1 7
Diameter determination (only for MC 5 (-0CE), SC 2 (-0CE)	F2/	2 1 7
"EUREKA" air buoyancy cor. program	F2/	2 1 8
Tare memory/net total	F1/	2 2 2
Over/under (net weight)	F1/	2 2 3
Over/under (difference in weight)	F1/	2 2 4

Automatic output of parameters	Code
Off	7 1 1 *
Reference %/qty. + reference weight	7 1 2
Reference weight only	7 1 3

Automatic tare output/print	Code
Individual tare weight	7 3 1 *
Total tare weight	7 3 2

Readout in percent	Only for MC5 (-0CE), SC2 (-0CE) Code	For all other models Code
Without decimal	3 5 1	3 6 1
1 decimal	3 5 2 *	3 6 2
2 decimals	3 5 3	3 6 3 *
3 decimals	3 5 4	3 6 4

Differential Weighing and Backweighing

Weighing sequence	Only for MC5 (-0CE), SC2 (-0CE) Code	For all other models Code
Individual weighing	3 6 1	3 7 1
Consecutive individual weighing	3 6 2 *	3 7 2 *
Combined weighing	3 6 3	3 7 3

Fully Automatic Draft Shield

You can define the fully automatic draft shield function to meet the most diverse requirements to combine work procedures and make them easier. After you have pressed a function key or after a control command has been received, the draft shield will close automatically, and the balance will then perform the particular function activated by the key. If code 8 8 2 or 8 8 3 is set, the draft shield will open once the function selected has been performed.

Automatic draft shield function	Code
Off	8 8 1
Shut/perform function/open	8 8 2
Shut/perform functon w/delay/open	8 8 3
Shut/perform function	8 8 4 *
Shut/perform function w/delay	8 8 5

Reset Function

This function enables you to reset all menu codes back to the original factory settings, which are indicated with an "*." Set menu code 9 – – 1°, press TARE/ to confirm; then press CF.

* = factory setting